FOURTEENTH ANNUAL REPORT

OF THE

WATER COMMISSIONER

FOR THE YEAR ENDING

JANUARY 31, 1909

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Printed for the Department

CITY OF BOSTON
PRINTING DEPARTMENT
1909

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FOURTEENTH ANNUAL REPORT

OF THE

WATER DEPARTMENT

FOR THE YEAR 1908–1909.

OFFICE OF THE WATER COMMISSIONER,
CITY HALL, BOSTON, February 1, 1909.

HON. GEORGE A. HIBBARD,
Mayor of the City of Boston:

SIR,—I submit herewith the fourteenth annual report of the doings of the Water Department covering the year ending January 31, 1909. This report has been prepared, as far as possible, in accordance with the suggestions of the Boston Finance Commission.

The receipts and disbursements of the department for the year were as follows:

Total receipts from all sources	$2,695,761 00
Total expenditures for all purposes	$2,695,761 00

TOTAL RECEIPTS OF THE YEAR BY SOURCES.

Sales of water	$2,626,564 59
Service, elevator, fire and motor pipes and repairs, labor, materials, etc.	34,985 84
Sale of old materials	5,652 54
Fees for summonses	2,924 40
Sale of merchandise (mostly to other departments)	2,649 01
Shutting off and letting on water on account of repairs	1,884 19
Shutting off and letting on water on account of nonpayment of bills	1,794 00
Use of West Roxbury pumping plant	786 36
Carried forward	$2,677,240 93

Brought forward	$2,677,240 93
Board of City Engineer's horse	624 00
Difference on cost of laying main pipe	475 50
Car tickets redeemed	359 45
Interest on deposits	228 14
Miscellaneous	145 88
	$2,679,073 90
Transfer by City Auditor to meet deficiency	16,687 10
	$2,695,761 00

EXPENDITURES.

Current expenses and extensions	$729,677 14
Metropolitan water assessment	1,789,315 84
Interest on funded debt	175,010 17
Refunded water rates	1,757 85
	$2,695,761 00

For detailed account of expenditures, condition of water debt, etc., see statements annexed.

Reports of work performed in the Income and Distribution Divisions and the Engineering Department will be found in the appendices annexed hereto.

Respectfully,

WILLIAM E. HANNAN,
Water Commissioner.

Details of expenditures under the appropriation for current expenses for the fiscal year ending January 31, 1909. (From revenue and transfer.)

Salaries and wages:		
William J. Welch, commissioner to April 27, 1908, inclusive	$1,625 00	
William E. Hannan, commissioner from April 28, 1908, inclusive	3,375 00	
	$5,000 00	
Assistant Commissioners:		
Isaac Rosnosky	3,000 00	
Joseph J. Norton, to April 1, 1908	750 00	
James P. Lennon, to April 1, 1908	750 00	
John J. Feneno, secretary, to January 15, 1908 (balance due)	104 17	
Walter E. Swan, chief clerk	3,000 00	
Employees	467,819 42	
		$480,423 59
Carried forward		$480,423 59

Brought forward		$480,423 59
Water pipes and other castings		99,218 94
Blasting and excavating pipe trenches and laying water pipes		40,854 50
Stable:		
Board, feed, etc.	$10,437 67	
Vehicles and repairs	2,888 46	
Horseshoeing	2,505 81	
Horses, purchase of	2,090 00	
Harnesses and repairs, etc.	1,229 05	
Veterinary services, etc.	705 62	
		19,856 61
Repairs and alterations of buildings, repairs of streets and structures		13,437 24
Lead and lead pipe		12,654 05
Meters:		
New meters	$9,964 00	
Repairs and extra parts	1,889 12	
		11,853 12
Tools and machinery and repairs of same, iron, steel, hardware and small supplies		10,593 99
Lumber		8,843 20
Printing		3,560 62
Fuel		3,420 46
Traveling expenses and transportation of employees		3,382 20
Salt		3,017 85
Gravel and crushed stone		2,509 46
Teaming, freights and expressage		2,238 58
Telephones		2,235 53
Stationery, postage, etc.		1,983 39
Automobile	$1,650 00	
Automobile repairs	264 52	
		1,914 52
Cement, lime and sand		1,219 95
Rents		641 00
Oils		552 13
Furniture		500 98
Gas		357 64
Taxes		327 75
Bricks		313 00
Professional and expert services		244 00
Waterproof clothing		230 57
Salt hay		175 44
Advertising		158 89
Drain pipe		77 68
Premiums on surety bonds		50 00
Removing trees		40 00
Recording papers		30 50
Decorations, "Old Home Week"		20 00
Displacement of tide water, assessment		21 38
Inspection of boilers		5 00
Copy of records		1 00
Ice for freezing water pipes		50
		$726,965 26
Damages		2,711 88
		$729,677 14

Comparative Table of Receipts and Expenditures.

Receipts.

	1904–05.	1905–06.	1906–07.	1907–08.	1908–09.
Sales of water	$2,388,428 81	$2,400,764 31	$2,471,726 19	$2,558,614 34	$2,626,564 59
Other receipts	56,794 04	58,315 50	80,118 91	67,975 43	52,509 31
	$2,445,222 85	$2,459,079 81	$2,551,845 10	$2,626,589 77	$2,679,073 90
Loan, extension of mains		330,000 00	300,000 00		
Credited from taxes	160,699 98	200,000 00	120,000 00		
Transfers by City Auditor				35,878 85	16,687 10
	$2,605,922 83	$2,989,079 81	$2,971,845 10	$2,662,468 62	$2,695,761 00
Balance, beginning of year	*$284,512 15	*$23,727 34	*$17,540 97 †9,460 67 $27,001 64	*$16,365 90 †54,739 39 $71,105 29	
Balance, end of year	*$23,727 34	*$17,540 97 †9,460 67 $27,001 64	*$16,365 90 †54,739 39 $71,105 29		

Expenditures.

	1904–05.	1905–06.	1906–07.	1907–08.	1908–09.
Current expenses	$543,747 20	$541,375 59	$544,769 54	$646,191 07	‡$729,677 14
Metropolitan water assessment	1,700,274 07	1,758,635 00	1,822,556 33	1,726,588 68	1,789,315 84
Interest	360,815 00	348,188 36	257,764 85	178,217 66	175,010 17
Refunded water rates	1,086 56	1,420 19	1,475 66	1,210 60	1,757 85
Extension of mains:					
From loans	260,784 81	336,186 37	301,175 07	16,365 90	
From appropriation from revenue				165,000 00	
	$2,866,707 64	$2,985,805 51	$2,927,741 45	$2,733,573 91	$2,695,761 00

* Loan. † Taxes.

‡ This amount was expended for current expenses and extensions, there being one appropriation only.

There was also expended by the Water Department, under an appropriation of $5,000, from the Reserve Fund, for ice for drinking fountains (order of City Council, approved May 21, 1908):

Ice	$3,503 77
Advertising	31 50
	$3,535 27

COST OF CONSTRUCTION AND CONDITION OF THE WATER DEBT.

The outstanding water loans February 1, 1908, were	$4,531,500 00
The outstanding water loans February 1, 1909, were	4,249,500 00
Decrease during the year	$282,000 00
The Water Sinking Fund February 1, 1908, was	$3,794,779 37
The Water Sinking Fund February 1, 1909, was	3,637,956 71
Decrease during the year	$156,822 66
Net water debt February 1, 1908	$736,720 63
Net water debt February 1, 1909	611,543 29
Decrease during the year	$125,177 34
Stock on hand February 1, 1908	$165,453 29
Stock on hand February 1, 1909	129,578 98
Decrease during the year	$35,874 31

The following statement relating to the cost of the water-works has been prepared by the chief clerk, Mr. W. E. Swan, and is probably as correct an account as it is possible to obtain at the present time.

While the cost of the plant now owned by the city represents an amount of $15,390,574.32, it is a question whether this amount does not considerably exceed the actual value of the works.

COST OF WORKS.

Cochituate supply	$1,715,950 73
Sudbury supply	9,267,367 04
Mystic supply	1,806,316 72
Distribution system	15,196,885 49
Total cost, January 1, 1898, exclusive of state takings,	$27,986,519 98
Cost of portion taken by the state	14,717,009 30
Cost of portion remaining	$13,269,510 68

Cost of portion taken by the state	$14,717,009 30
Total payments by state	13,685,766 84
Excess of cost over amount paid	$1,031.242 46

Cost in detail of portion of original works, exclusive of state taking:

Brookline Reservoir	$200,077 21
Beacon Hill Reservoir	363,533 21
South Boston Reservoir	90,908 10
Jamaica Pond Aqueduct	88,417 20
East Boston Reservoir	66,103 09
Parker Hill Reservoir	205,793 81
Fisher Hill Reservoir	191,135 35
Roxbury high service	103,829 53
Brighton high service	7,745 00
East Boston high service	30,208 12
West Roxbury high service	22,346 56
Pipe yards and buildings	94,832 16
Engineering expenses	57,873 58
Distribution	10,871,844 18
Cochituate works	$12,394,647 10
Mystic works (distribution)	874,863 58
Cost, January 31, 1898	$13,269,510 68

Additions to cost on account of extension of mains, etc. (eleven years to January 31, 1909), viz.:

Year ending January 31, 1899	$411,910 26	
" " 31, 1900	446,120 35	
" " 31, 1901	364,604 06	
" " 31, 1902	259,228 99	
" " 31, 1903	125,705 99	
" " 31, 1904	117,501 25	
" " 31, 1905	221,595 49	
" " 31, 1906	313,465 41	
" " 31, 1907	293,734 68	
" " 31, 1908	220,239 57	
" " 31, 1909	182,602 70	
		2,956,708 75
		$16,226,219 43

Cost represented on waterworks ledger, January 31, 1909,	$17,257,461 89
Cost represented by above statement on same date	16,226,219 43
Excess of cost represented over amount paid by state,	$1,031,242 46

The following is a statement of the cost of the existing works on January 31, 1909:

East Boston Reservoir	$66,103 09
Parker Hill Reservoir	205,793 81
Fisher Hill Reservoir	191,135 35
East Boston high service	24,173 26
West Roxbury high service	22,346 56
Pipe yards and buildings	94,832 16
Engineering expenses	57,873 58
Distribution	14,728,316 51
Total	$15,390,574 32

In making up this statement, the difference between the cost to the city of the portion taken by the state and the total amount paid by the state for said portion ($1,031,242.46) has been eliminated, and the items Brookline, Beacon Hill and South Boston reservoirs and the Brighton high service works have also been eliminated as they no longer exist in the waterworks plant. The two former reservoirs were taken from the waterworks assets without compensation to the department. A portion of the South Boston Reservoir property was taken for schoolhouse purposes, the department being compensated for land taken, and the remainder of the property being turned over to the Public Grounds Department. The standpipe in Roxbury, which formed a part of the Roxbury high service, was also transferred to the Public Grounds Department without reimbursement, and the Roxbury pumping works have long since been abandoned; consequently only the value of the pipes formerly connected with the high service works which are in existence at the present time has been considered, and the amount of $23,829.53 of the original item of $103,829.53 has been lumped with distribution. Of the original cost of the East Boston high service ($30,208.12) the sum of $6,034.86, representing the cost of the old pumps, boilers and foundations, has been deducted, leaving the cost of the remaining portion of these works at $24,173.26. The Jamaica Pond Aqueduct works, which cost the city $88,417.20, have also long since been out of existence. The value of the mains now remaining in service is placed at $4,900, which amount has also been carried into the distribution item. The construction account on the books of the department has been modified to conform to the above revised account and henceforth such additions or extensions as are made from time to time will be added to the cost of the plant.

The outstanding water loans on February 1, 1909, were as follows:

Loans.	Date of Maturity.	Amount.
4 per cent loan, due	July, 1909	$64,000 00
4½ " " " "	October, 1909	120,000 00
4 " " " "	April, 1910	253,000 00
4 " " " "	April, 1912	324,000 00
4 " " " "	October, 1913	50,000 00
4 " " " "	January, 1914	459,000 00
4 " " " "	April, 1914	9,500 00
4 " " " "	October, 1914	10,000 00
4 " " " "	April, 1915	32,700 00
4 " " " "	October, 1915	17,000 00
4 " " " "	January, 1916	8,000 00
4 " " " "	April, 1916	18,500 00
Carried forward		$1,365,700 00

Loans.	Date of Maturity.	Amount
Brought forward		$1,365,700 00
4 per cent loan, due	October, 1916	11,300 00
4 " " " "	January, 1917	8,000 00
3½ " " " "	April, 1917	275,000 00
4 " " " "	April, 1917	6,000 00
4 " " " "	October, 1917	157,700 00
4 " " " "	January, 1918	13,000 00
4 " " " "	April, 1918	300 00
3½ " " " "	July, 1918	100,000 00
4 " " " "	October, 1918	95,000 00
4 " " " "	April, 1919	200,000 00
3½ " " " "	October, 1919	2,000 00
4 " " " "	October, 1919	189,000 00
3½ " " " "	November, 1919	106,000 00
3½ " " " "	January, 1920	70,000 00
4 " " " "	October, 1920	172,500 00
4 " " " "	April, 1921	100,000 00
4 " " " "	October, 1921	140,500 00
4 " " " "	January, 1922	80,000 00
4 " " " "	April, 1922	75,000 00
4 " " " "	October, 1922	193,000 00
4 " " " "	October, 1923	18,275 00
4 " " " "	October, 1924	436,225 00
3½ " " " "	October, 1927	25,000 00
3½ " " " "	July, 1929	410,000 00
Total		$4,249,500 00

SUMMARY.

3½ per cent loans	$988,000 00
4 " " "	3,141,500 00
4½ " " "	120,000 00
Total	$4,249,500 00

COCHITUATE WATER SINKING FUND RECEIPTS.

[*Since the Establishment of the Board of Sinking Fund Commissioners in 1871.*]

Year.	From Tax Levy of City Income.	Interest on Investments.	Interest on Bank Deposits.	Water Rates, etc.	Premiums on Loans.	Other Sources.	Totals.
1871, April 30, received from Committee on Reduction of Debt,	$1,100,000 00	.....	.....	.....	.....	.....	$1,100,000 00
1871–72	14,325 00 Taxes, 9,375 00	$61,000 00	$349 67	.....	.....	.....	85,049 67
1872–73	9,000 00	70,137 50	1,017 80	.....	.....	.....	80,155 30
1873–74	30,090 00	76,799 60	2,072 65	.....	.....	.....	108,962 25
1874–75	75,973 28	82,842 25	2,121 13	.....	.....	.....	160,936 66
1875–76	65,554 00	85,470 00	3,617 55	.....	.....	$386 00	155,027 55
1876–77	234,814 00	86,245 66	4,119 47	$26,480 18	.....	915 46	352,574 77
1877–78	Taxes, 214,500 00	85,830 85	10,809 31	27,099 92	.....	.....	338,240 08
1878–79	Taxes, 207,456 00	93,264 49	6,181 26	177,195 91	.....	9,874 21	493,971 87
1879–80	.....	90,472 42	5,687 62	214,707 24	.....	4,411 64	315,278 92
1880–81	.....	86,460 00	167 32	195,668 90	.....	1,762 04	284,058 26
1881–82	.....	96,546 35	2,767 90	193,840 36	.....	494 08	293,648 69
1882–83	.....	105,129 51	8,486 33	216,581 72	.....	1,241 04	331,438 60
1883–84	Taxes, 973 00	138,120 90	2,268 22	.....	.....	.....	141,362 12
1884–85	.....	143,049 45	7,510 40	209,258 39	.....	.....	359,818 24
1885–86	.....	156,694 01	5,804 31	120,129 12	.....	442 27	283,069 71
1886–87	Taxes, 75,496 00	181,264 89	2,644 70	297,928 95	.....	5,081 12	562,415 66
1887–88	.....	199,883 90	4,178 16	221,620 11	.....	.....	425,682 17
1888–89	.....	213,048 22	8,958 69	256,013 57	$11,552 50	.....	489,572 98
1889–90	.....	228,000 83	11,730 60	300,903 00	36,092 50	.....	576,726 93
Amount carried forward	$2,037,556 28	$2,280,260 83	$90,493 09	$2,457,427 37	$47,645 00	$24,607 86	$6,937,990 43

COCHITUATE WATER SINKING FUND RECEIPTS.— *Concluded.*

YEAR.	From Tax Levy of City Income.	Interest on Investments.	Interest on Bank Deposits.	Water Rates, etc.	Premiums on Loans.	Other Sources.	Totals.
Amount brought forward	$2,037,556 28	$2,280,260 83	$90,493 09	$2,457,427 37	$47,645 00	$24,607 86	$6,937,990 43
1890–91		229,509 17	29,763 94	242,675 22	36,530 00		538,478 33
1891–92		175,808 33	22,560 16	275,014 05		78,865 00	552,247 54
1892–93		260,506 20	30,148 34	240,435 00	16,413 50		547,503 04
1893–94		298,224 44	18,133 03	299,467 27	14,621 75		630,446 49
1894–95		312,332 05	18,524 22	297,518 29		9,894 12	638,268 68
1895–96		378,819 55	5,892 29	205,791 00	64,690 00		655,192 84
1896–97		403,840 02	5,225 08	194,740 00		616 50	604,421 60
1897–98		421,928 45	8,337 21	193,395 00	8,833 50	15,877 86	648,372 02
1898–99		417,142 02	5,806 85	193,395 00		8,016 00	624,359 87
1899–1900		383,662 97	7,632 45	209,824 00	29,835 70	2,148 90	633,104 02
1900–1901		397,985 35	15,948 83	206,489 00			620,423 18
1901–1902		325,030 96	31,199 25			* 609,000 00	965,230 21
1902–1903		313,707 65	37,297 28				351,004 93
1903–1904		149,255 27	8,318 82			282 10	157,856 19
1904–1905		260,239 40	5,547 25				265,786 65
1905–1906		242,176 39	13,015 36				255,191 75
1906–1907		171,618 65	16,038 95				187,657 60
1907–1908		126,325 04	2,064 84				128,389 88
1908–1909		126,812 87	2,130 23				128,943 10
	$2,037,556 28	$7,675,185 61	$374,077 47	$5,016,171 20	$218,569 45	$749,308 34	$16,070,868 35

* Waterworks Fund.

Cochituate Water Debt, Gross and Net.

At the Close of Each Fiscal Year.

FISCAL YEAR.	Gross Debt.	Sinking Funds.	Net Debt.
1847–48	[1]$2,129,056 32	.....	$2,129,056 32
1848–49	3,787,328 98	.....	3,787,328 98
1849–50	4,463,205 56	.....	4,463,205 56
1850–51	4,955,613 51	.....	4,955,613 51
1851–52	5,209,223 26	.....	5,209,223 26
1852–53	5,972,976 11	.....	5,972,976 11
1853–54	5,432,261 11	.....	5,432,261 11
1854–55	5,403,961 11	.....	5,403,961 11
1855–56	5,230,961 11	.....	5,230,961 11
1856–57	5,031,961 11	.....	5,031,961 11
1857–58	4,724,961 11	.....	4,724,961 11
1858–59	4,754,461 11	.....	4,754,461 11
1859–60	3,846,211 11	.....	3,846,211 11
1860–61	3,455,211 11	.....	3,455,211 11
1861–62	3,012,711 11	.....	3,012,711 11
1862–63	2,992,711 11	.....	2,992,711 11
1863–64	2,992,711 11	.....	2,992,711 11
1864–65	2,942,711 11	.....	2,942,711 11
1865–66	3,152,711 11	.....	3,152,711 11
1866–67	3,370,711 11	.....	3,370,711 11
1867–68	3,867,711 11	.....	3,867,711 11
1868–69	5,107,711 11	.....	5,107,711 11
1869–70	5,731,711 11	.....	5,731,711 11
1870–71	6,482,711 11	$1,100,000 00	5,382,711 11
1871–72	6,812,711 11	1,185,049 67	5,627,661 44
1872–73	6,912,711 11	1,268,234 97	5,644,476 14
1873–74	7,863,711 11	1,372,952 62	6,490,757 49
1874–75	8,123,711 11	1,533,890 28	6,589,820 83
1875–76	9,735,711 11	1,560,917 83	8,174,793 28
1876–77	11,548,711 11	1,709,492 60	9,839,218 51
1877–78	11,545,273 98	2,043,764 73	9,501,509 25
1878–79	11,753,273 98	2,143,847 85	9,609,426 13
1879–80	11,697,273 98	1,771,692 92	9,925,581 06
1880–81	11,631,273 98	1,989,300 88	9,641,973 10
1881–82	11,631,273 98	2,281,857 89	9,349,416 09
1882–83	11,955,273 98	2,607,768 46	9,347,505 52
1883–84	12,882,273 98	2,746,505 58	10,135,768 40
1884–85	13,045,473 98	3,106,323 82	9,939,150 16
1885–86	13,491,473 98	3,385,201 26	10,106,272 72
1886–87	14,142,273 98	3,947,616 92	10,194,657 06
1887–88	14,741,273 98	4,373,304 09	10,367,969 89
1888–89	14,941,273 98	4,864,092 54	10,077,181 44
1889–90	15,696,273 98	5,440,819 47	10,255,454 51
1890–91	16,267,773 98	5,979,297 80	10,288,476 18
1891–92	16,423,773 98	6,471,545 34	9,952,288 64
1892–93	16,758,773 98	7,019,058 38	9,739,715 60
1893–94	17,055,273 98	7,649,504 87	9,405,769 11
1894–95	17,761,273 98	8,444,773 55	9,316,500 43
1895–96	18,261,273 98	9,099,966 39	9,161,307 59
1896–97	18,261,273 98	9,704,387 99	8,556,885 99
1897–98	17,911,273 98	9,852,760 01	8,058,513 97
1898–99	17,121,273 98	9,487,119 88	7,634,154 10
1899–1900	17,306,273 98	9,870,223 90	7,436,050 08
1900–1901	11,960,273 98	10,144,647 08	1,815,626 90
1901–1902	11,351,917 28	10,422,449 77	929,467 51
1902–1903	9,501,000 00	8,893,615 94	607,384 06
1903–1904	8,227,000 00	7,337,902 79	889,097 21
1904–1905	8,224,000 00	7,600,689 44	623,310 56
1905–1906	6,671,250 00	5,943,222 39	728,027 61
1906–1907	4,562,500 00	3,697,913 53	864,586 47
1907–1908	4,531,500 00	3,794,779 37	736,720 63
1908–1909	4,249,500 00	3,637,956 71	611,543 29

[1] No account taken of amounts borrowed temporarily from 1846 to 1852 and afterwards funded by the issue of water bonds that figure in this statement.

CONTRACTS MADE AND PENDING DURING YEAR COMMENCING FEBRUARY 1, 1908, AND ENDING JANUARY 31, 1909.

MISCELLANEOUS CONTRACTS.

Contracts marked thus (*) are completed.

Date.	Contractors.	Manner of Awarding Contract.	Work.	Price or Amount.	Paid on Contract.		
					Previous Year.	Year 1908-1909.	Total.
1906.							
* Nov. 22,	Robert Eagar	Authority of Mayor, without advertising	Laying line of 48-inch water pipe in Prentiss and Parker streets and in Longwood avenue from Columbus avenue to St. Alphonsus street	$1.80 per linear foot for trench work and laying pipe $5 per cubic yard for rock excavation 17 cents per linear foot for resetting edgestones, including all incidentals 50 cents per square yard for repaving and resetting crosswalks, including all incidentals	$10,193 36	$2,640 50	$12,833 86
1907.							
* Feb. 28,	J. H. McCafferty & Co.	Authority of Mayor, without advertising	Composition castings for year ending January 31, 1908	Basis of last year's contract price plus increase in price of raw materials. Prices to be adjusted quarterly Prices last year: No. 1, 25 cents per pound No. 2, 25½ " " No. 3, 20 " "	10,924 78	3,106 03	14,030 81
* Nov. 1,	Foxboro Foundry Co.	Authority of Mayor, without advertising	Miscellaneous iron castings for three months from November 1, 1907, to January 31, 1908	No. 1, @ $3\frac{8}{16}$ cents per pound No. 2, @ $3\frac{1}{8}$ cents per pound.	2,307 88	6,344 12	8,652 00

1908.							
* Feb. 25,	Warren Foundry and Machine Co.	Lowest bid in competition; advertised	Cast-iron water pipes and special castings delivered at yard, 710 Albany street. Estimated quantities: 5 tons 4-inch pipe, B 40 " 6-inch " " 120 " 8-inch " " 210 " 10-inch " " 430 " 12-inch " " 200 " 16-inch " " 15 " special castings	$24.50 per ton, 2,000 pounds. $24.25 " " $50 " "	.....	25,280 12	25,280 12
Feb. 25,	J. H. McCafferty & Co.	Lowest bid in competition; advertised	Composition castings for year ending January 31, 1909. Estimated quantities: 6,000 pounds No. 1 30,000 " No. 2 4,000 " No. 3	22 cents per pound 19½ " " 15 " "	.....	6,113 32	6,113 32
Feb. 25,	Charles Duncan & Son	Lowest bid in competition; advertised	Teaming water pipes, etc., for year ending January 31, 1909	82 cents per ton, 2,000 pounds, within 2½ miles from pipe yard $1.42 per ton, 2,000 pounds, over 2½ miles from pipe yard	.....	1,326 02	1,326 02
Feb. 28,	Mechanics' Iron Foundry Co.	Lowest bid in competition; advertised	Iron castings for year ending January 31, 1909. Estimated quantities: 800,000 pounds No. 1 140,000 " No. 2	$2.85 cents per pound $2.25 " "	.....	15,801 90	15,801 90
*Apr. 17,	John T. Shea, Jr.	Lowest bid in competition; Not advertised,	Repaving over water pipe trench, Congress street	$2 per square yard	.....	1,551 00	1,551 00
* May 12,	William Higgins	Lowest bid in competition; not advertised,	Repaving over water pipe trench, Beverly street	$1.88 per square yard	.....	734 26	734 26
* June 22,	Boston Ice Co.	One of two bids at same price in competition; advertised	Furnishing ice for public drinking fountains in East Boston and Charlestown, from June 12 to September 12, 1908	$3 per ton, 2,000 pounds	.....	.....	[1]

[1] $899.85 paid from special appropriation.

MISCELLANEOUS CONTRACTS.—*Concluded.*

Contracts marked thus (*) are completed.

Date.	Contractors.	Manner of Awarding Contract.	Work.	Price or Amount.	Paid on Contract.		
					Previous Year.	Year 1907–1908.	Total.
1908.							
*June 22,	Hygeia Ice Co.....	One of three bids, all at same price in competition; advertised.....	Furnishing ice for public drinking fountains in City Proper, South Boston, Roxbury and West Roxbury, from June 12 to September 12, 1908.....	$3 per ton, 2,000 pounds.....	.....	.....	[2]
Aug. 6,	Camden Iron Works.	Lowest of three bids in competition; advertised.....	Cast-iron water pipes and special castings delivered at yard, 710 Albany street..... Estimated quantities: 5 tons 4-inch pipe, B ..... 70 " 6-inch " " ..... 170 " 8-inch " " ..... 300 " 10-inch " " ..... 460 " 12-inch " " ..... 280 " 16-inch " " ..... 10 " 24-inch " " ..... 410 " 48-inch " [1]A ..... 25 " special castings.....	$22.45 per ton, 2,000 pounds, $22.30 per ton, 2,000 pounds. $50 " " " ...	.....	$39,145 59	$39,145 59
*Oct. 9,	Carl E. Fosberg.....	Lowest bid in competition; not advertised,	Painting fence surrounding Water Department yard, Gibson street, Dorchester, two coats both sides.....	$115.....	.....	115 00	115 00
Nov. 23,	Eastern Salt Co....	Lower of two bids in competition; not advertised.	Salt for use on hydrants, etc., during winter season of 1908–1909.....	60 cents per sack delivered at the several divisions...	.....	1,350 60	1,350 60

[1] Changed to "B" weight by subsequent order of Water Commissioner.

[2] $2,603.92 paid from special appropriation.

CONTRACTS FOR TRENCH WORK, ETC.

DATE.	CONTRACTORS.	MANNER OF AWARDING CONTRACT.	LOCATION.	QUANTITIES AND PRICES BID.				PAID ON CONTRACT.	
				Linear Feet of Trench.	Cu. Yds. Excavation and Refilling.	Cu. Yds. Rock Excavation.	Sq. Yds. Paving.	Extra Work.	Total.
1907.									
Oct. 1,	Patrick H. Bradley & Co.....	Without competition.....	Laying 10-inch and 8-inch water pipes in Necco street and Necco court, respectively.....	382 @ 40c.	.....	19.6 @ $5	114 @ 25c.	.....	$251 70* 27 60†
Dec. 5,	Orient Construction Company,	Without competition.....	Laying 8-inch water pipe, Faxon street, East Boston.....	356.5 @ 50c.	.....	.....	.....	$35 08	213 33
Dec. 28,	Daniel E. Lynch.....	Without competition.....	Laying 8-inch water pipe, Rockdale street, Dorchester.....	274 @ 50c.	.....	50 @ $5	.....	25 30	412 30
1908.									
April 22,	Hub Construction Company..	Competition; not advertised; next to lowest bid. Lowest bid (at 25 cents, $1 and $5, respectively) withdrawn....	Laying 10-inch water pipes in Prince street extension, West Roxbury....	573 @ 46c.	17.2 @ $1 10	@ $4	.....	4 89	287 39
May 8,	Frank A. Foster.....	Lowest bid in competition; not advertised.....	Laying 12-inch water pipes in Wellington Hill street, Dorchester.....	1,703 @ 40c.	13 @ 75c	26 @ $4	.....	2 74	797 69
June 9,	Hub Construction Company..	Lowest bid in competition; not advertised.....	Laying 12-inch water pipes in Itasca street, Dorchester.....	453 @ 38c.	14.2 @ $1	2 @ $4	.....	29 51	223 85

* Paid to contractor.

† Expended by city to complete work.

CONTRACTS FOR TRENCH WORK, ETC.— *Continued.*

Date.	Contractors.	Manner of Awarding Contract.	Location.	Quantities and Prices Bid.				Paid on Contract.	
				Linear Feet of Trench.	Cu. Yds. Excavation and Refilling.	Cu. Yds. Rock Excavation.	Sq. Yds. Paving.	Extra Work.	Total.
1908. June 19,	Fred S. and A. D. Gore Corporation	Competition; not advertised; next to lowest bid. Lowest bid (at 36 cents, 60 cents, $5 and 40 cents, respectively) withdrawn	Relaying water pipes in Parkman street and partly across Dorchester avenue and Adams street, Dorchester. (12-inch in place of 6-inch.)	1,308 @ 47c.	52.3 @ 60c.	0.5 @ $4 50	28.4 @ 50c.	$14 78	$677 37
June 24,	Frank A. Foster	Lowest bid in competition; not advertised	Relaying water pipes in Gibson street and partly across Adams street, Dorchester. (10-inch in place of 6-inch.)	1,142 @ 49c.	26 @ 50c.	9.1 @ $1	29.6 @ 50c.	$4 78	601 26
July 3,	John H. Gerrish	Lowest bid in competition; advertised	Laying 12-inch water pipes, flexible joints, between Moon and Long Islands	Esti feet $3 40	mated to lay.	3,200 l	inear		Not completed. $7,000*
July 3,	John H. Gerrish	Lowest bid in competition; advertised	Laying 4-inch water pipes, flexible joints, between Long and Rainsford Islands	Esti feet $3 95	mated to lay.	3,525 l	inear		Not completed. $6,000*
July 22,	John A. Costello & Co	Lowest bid in competition; not advertised	Relaying water pipes in Hampshire street, Roxbury, from Linden Park street to Whittier place. (8-inch in place of 6-inch.)	937.5 @ 46c.	18 @ $4	@ 10c.	17 @ 30c	39 10	555 95
Aug. 5,	Hub Construction Company	Lowest bid in competition; not advertised	Laying (and lowering about 60 feet) 20-inch water pipes in Telegraph, Gates and Dorchester streets, South Boston	....	1,052 @ $1 10	@ $4	94 @ 40c.	102 06	1,296 86
Aug. 6,	Fred S. and A. D. Gore Corporation	Lowest bid in competition; not advertised	Laying 10-inch water pipes in South Munroe terrace and partly across Neponset avenue and Train street, Dorchester	928 @ 60c.	26.2 @ $1	8 @ $2 50	.....	3 02	606 02

Sept. 2,	Frank H. Cowin Company	Lowest bid in competition; not advertised	Laying 8-inch water pipes in Johnswood road, West Roxbury	1,108 @ 42c.	21 @ 50c.	4.5 @ $4 50	.....	.....	496 11
Sept. 15,	Fred S. and A. D. Gore Corporation	Lowest bid in competition; not advertised	Relaying water pipes in Clarendon street, from Warren avenue to Columbus avenue. (12-inch in place of 6-inch.)	1,097 @ 59c.	10 @ 50c.	@ 50c.	21 @ 50c.	5 75	668 48
Sept. 17,	John A. Costello & Co. (assigned to Pacific Surety Co.)	Lowest bid in competition; not advertised	Relaying water pipes in Batterymarch street, from Milk street to High and Broad streets. (10-inch in place of 6-inch.)	820 @ 70c.	129 @ 60c.	1 @ 1c.	383 @ 35c.	79 06	864 52
Oct. 5,	Robert Eagar, Jr	Lowest bid in competition; advertised	Laying 12-inch water pipes in Washington street, West Roxbury	1,459 @ $1	43 @ 50c.	382 @ 1c.	.....	.....	1,484 32
Oct. 7,	Thomas H. Connolly	Only bid in response to invitation; not advertised	Laying 12-inch water pipes in Terminal street, Charlestown	Esti feet 90c.	mated to lay. 50c.	970 lin $4	ear 30c.	.....	Not completed. $831 60*
Oct. 12,	Daniel E. Lynch	Lowest bid in competition; not advertised	Relaying water pipes in Corning street. (12-inch in place of 6-inch.)	347 @ 65c.	26 @ 80c.	@ $4 50	16 @ 50c.	.....	254 35
Oct. 20,	William L. Dolan	Lowest bid in competition; not advertised	Relaying water pipes in Magnolia and Wayland streets, Dorchester. (12-inch in place of 6-inch.)	1,283 @ 55c.	2 @ 45c.	5.7 @ $3	7 @ 45c.	85 10	811 90
Oct. 31,	Thomas Burke	Lowest bid in competition; not advertised	Relaying water pipes in Massachusetts avenue, from Washington street to Tremont street, and partly across Tremont street. (12-inch in place of 4-inch and 6-inch.)	1,304 @ 47c.	58.5 @ 70c.	@ 1c.	64 @ 35c.	25 43	701 66
Nov. 12,	Thomas H. Connolly	Lowest bid in competition; not advertised	Relaying water pipes in Chelsea street, East Boston, from south side of Porter street to 20 feet beyond north line of Brooks street. (16-inch in place of 12-inch.)	Esti feet. 70c.	mated $1	1,460 l 1c.	inear 75c.	.....	Not completed. $683 90*

* Paid on account.

CONTRACTS FOR TRENCH WORK, ETC.— *Concluded.*

Date.	Contractors.	Manner of Awarding Contract.	Location.	Quantities and Price Bid.				Paid on Contract.	
				Linear Feet of Trench.	Cu. Yds. Excavation and Refilling.	Cu. Yds. Rock Excavation.	Sq. Yds. Paving.	Extra Work.	Total.
1908.									
Nov. 13,	Robert Eagar, Jr.	Awarded without competition at same prices as under his contract of October 5, 1908, for laying pipes in same street	Laying 10-inch water pipes in easterly side of Washington street, West Roxbury, from Rockland street to Grove street, and northerly from Grove street about 300 feet	1,687 @ $1	210 @ 50c.	259 @ 1c.	.....	$258 75	$2,053 34
Nov. 13,	James H. Ferguson	Lowest bid in competition; not advertised	Laying 6-inch water pipes on Long Island from end of 4-inch flexible joint pipe to 4-inch main	862 @ 75c.	20 @ $1	0.5 @ $2	.....	87 20	754 70
Nov. 14,	Bryne Contracting Company	Lowest bid in competition; not advertised	Laying 12-inch water pipes in Washington street, West Roxbury, from La Grange street to Heron street	1,627 @ 45c.	@ 50c.	305 @ $4	.....	75 30	2,027 45
Nov. 17,	Daniel E. Lynch	Lowest bid in competition; not advertised	Relaying water pipes in Chelsea street, East Boston, from south side of Porter street to and partly across Maverick street. (16-inch in place of 12-inch.)	Esti feet. 90c.	mated 80c.	1,370 l $3	inear 50c.	.....	Not completed.
Nov. 23,	John A. Costello & Co.	Lowest bid in competition; advertised	Laying 48-inch water pipes in Longwood avenue, from Brookline avenue to Riverway bridle path	617 @ $1 95	.....	@ $3	.....	203 55 *	$1,587 60†
Dec. 2,	John A. Costello & Co.	Without competition.	Moving 296 linear feet of 12-inch water pipe in Longwood avenue, between Brookline avenue and Autumn street, a distance of 18 inches, without cutting pipe	75c. p mo	er line ved.	ar foot	of pipe	.....	222 00

* Work partially done, $180.90.

† Contract terminated with approval of Mayor, and work to be completed by city.

CONTRACTS FOR BLASTING ROCK IN PIPE TRENCHES, — MADE WITHOUT ADVERTISING FOR BIDS.

DATE.	CONTRACTOR.	Manner of Awarding Contract.	LOCATION.	Quantity Paid For.	Price or Amount.	Paid on Contract.
1907.						
Nov. 26,	John Guarino	Lowest bid in competition	Fifield street, Dorchester	36 cubic yards	$5 49	$197 64
Dec. 28,	John Guarino	Lowest bid in competition	Strathcona road, Dorchester	29.9 cubic yards	3 97	118 70
1908.						
Jan. 28,	Robert J. O'Brien	Lowest bid in competition	Allston street, Brighton	22.4 cubic yards	4 00	89 60
Feb. 24,	Thomas Burke	Lowest bid in competition	Hawes avenue, Dorchester	89.3 cubic yards	3 00	267 90
May 6,	F. L. Williams	Lowest bid in competition	Sparrow street, West Roxbury	24.7 cubic yards	4 00	98 80
June 16,	John A. Costello & Co.	Lowest bid in competition	Whitney park, Dorchester	31.9 cubic yards	3 90	124 41
Sept. 10,	Thomas Burke	Lowest bid in competition	Santuit street, Dorchester	48.7 cubic yards	3 74	182 14
Dec. 16,	John McCourt	Lowest bid in competition	Commonwealth terrace, Brighton		3 75	Work completed but not paid for. 81 cubic yards, $303.75.
Dec. 26,	Thomas Burke	Lowest bid in competition	Hollingsworth street, Dorchester		4 49	Work completed but not paid for. 17.2 cubic yards, $77.23.

REPORT OF INCOME DIVISION.

OFFICE OF GENERAL SUPERINTENDENT,
CITY HALL, BOSTON, February 1, 1909.

WILLIAM E. HANNAN, ESQ.,
Water Commissioner:

DEAR SIR,— I submit herewith the annual report of the Income Division, Water Department. The report of the Meter Service Division, also the statement of water rates, covers the financial year ending January 31, 1909; the remainder of the report is rendered for the calendar year ending December 31, 1908,— it being impracticable, owing to the nature of our accounts, to render it for the financial year.

Respectfully submitted,

J. H. CALDWELL,
General Superintendent Income Division.

TABLE I.

Statement of Water Rates, January 31, 1909.

ACCOUNT OF YEAR.	Amount Assessed.	Amount Abated.	Amount Collected.	Balance Outstanding.
1895	$2,266,519 08	$55,510 53	$2,211,008 55	.....
1896	2,568,246 04	*95,162 39	2,473,083 65	.....
1897	2,630,413 37	53,864 09	2,576,549 28	.....
1898	2,342,804 58	†235,414 43	2,107,390 15	.....
1899	2,414,731 72	†258,449 66	2,156,282 06	.....
1900	2,197,026 64	46,873 45	2,150,153 19	.....
1901	2,264,845 26	46,713 28	2,218,131 98	.....
1902	2,327,996 91	43,706 89	2,284,290 02	.....
1903	2,386,428 02	58,050 51	2,328,347 51	$30 00
1904	2,391,751 16	38,290 92	2,352,679 94	780 30
1905	2,446,978 39	36,093 08	2,410,871 31	14 00
1906	2,524,105 25	37,534 28	2,486,505 97	65 00
1907	2,618,400 60	34,959 33	2,583,427 27	14 00
1908	2,644,677 24	20,657 30	2,594,208 33	29,811 61
‡1909	1,364,908 85	1,660 52	121,788 18	1,241,460 15

The above amounts for the years 1895, 1896 and 1897 include both Cochituate and Mystic supply accounts. The contracts to supply Chelsea, Somerville and Everett with Mystic water were abrogated by the Metropolitan Water Act of January 1, 1898.

* This amount includes certain city department accounts, abated by order of the Mayor.

† These amounts include abatements of city department accounts, under order of the City Council, approved by the Mayor on March 5, 1900, said order also abolishing all charges for water used by city departments.

‡ The statement of water rates for the year 1909 represents annual accounts only; the quarterly meter accounts can only be estimated at this time.

TABLE II.

Kind and Number of Fixtures in use December, 1908.

	Number.
Bathtubs	94,964
Bowls	130,825
Foot tubs	570
Sinks	192,685
Taps	35,697
Urinals, automatic	5,318
" otherwise	490
Washtubs	151,308
Water-closets	194,303
Total fixtures	806,160

TABLE III.

Number and Amount of Abatements Allowed during the Year 1908.

ON ACCOUNT OF ASSESSMENTS FOR YEAR.	Number.	Amount.
1906	96	$1,561 11
1907	1,764	16,440 15
1908	2,667	19,397 86
Totals	4,527	$37,399 12

TABLE IV.

New Elevator, Motor and Service Pipes.

Elevator pipes	11
Motor pipes	2
Fire pipes	37
Service pipes	1,205
Total	1,255

TABLE V.

Turning Water Off and On.

For complaints	709
For repairs of service	3,834
For nonpayment of water bills	2,354
For waste	31
Turned on first time	1,131
Vacancies	2,792
Total	10,841

TABLE VI.

Off and On Receipts.

Received for turning water off and on for repairs, and deposited with City Collector	$1,860 19

TABLE VII.

WASTE DETECTION.

Water Inspection.

Waste reports	11,577
First re-examinations	8,277
Second re-examinations	2,652
Third re-examinations	632
Fine notices issued	271

TABLE VIII.

Defective Fixtures and Waste.

Tank fixtures leaking	12,583
Faucets leaking	7,242
Bursts inside	494
Bursts outside	17
Hopper-cocks leaking	155
Water-closets leaking	468
Willful waste	19

TABLE IX.

ELEVATOR AND MOTOR SERVICE FOR THE YEAR ENDING DECEMBER 31, 1908.

Elevators.

Under supervision December 31, 1907		586	
Discontinued during year	8		
Changed to electric	3		
		11	
			575
New elevators accepted during the year			9
Under supervision December 31, 1908			584
Changed to tank and metered water and now under supervision			71
Inspections made			382
Accuracy tests made			357
Registering inaccurately and repaired by owners			41
Clock cord broken and repaired by owners			77
Clock hands broken and repaired by owners			5

Motors.

Under supervision December 31, 1907		116	
Discontinued		2	
			114
New motors added to service during the year			4
Under supervision December 31, 1908			118
Motors on meter			17

TABLE X.

FIRE PIPE SERVICE FOR THE YEAR ENDING DECEMBER 31, 1908.

Premises under supervision December 31, 1907		541
Supervision discontinued		10
		531
Premises equipped during the year		21
Under supervision December 31, 1908		552
Premises inspected		3,890
Total number of inspections of outlet valves		47,601
Total number of hydrant inspections		1,037
Total number of valves sealed and resealed		4,724
Total number of hydrant valves sealed and resealed		196
Meter by-passes under supervision December 31, 1907		37
Discontinued		2
		35
By-passes, additional		2
Under supervision December 31, 1908		37
Inspections made		287
Resealed		18

TABLE XI.

General Statement of Work Performed during Year Ending January 31, 1909.

	Meters.	Boxes.
Applied	434	115
Discontinued	238	.....
Changed	965	.....
Changed location	11	.....
Tested	2,685	.....
Repaired at shop	862	.....
Repaired at factory	113	.....
Repaired in service	314	153
Examined	181	.....
Lost	1	.....
Hayed	1,809	.....
Condemned	206	.....
Purchased	507	.....
In service	5,380	.....
In service (private)	132	.....
At department shop	361	.....

TABLE XII.

Statement of Meters for Year Ending January 31, 1909.

Meters belonging to department January 31, 1908	5,441	
Purchased	507	
		5,948
Condemned during year	206	
Lost (in service)	1	
		207
Belonging to department January 31, 1909		5,741

Distribution of Meters January 31, 1909.

In service	5,380	
In shop	361	
		5,741

TABLE XIII.

Meters Applied.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	.....	1	6	17	14	16	34	76	164
Hersey	1	.....	3	6	3	17	16	5	51
Hersey disc	.....	.....	.....	1	13	12	12	48	86
Worthington	.....	.....	1	3	1	1	5	.....	11
B. W. W	.....	.....	.....	.....	.....	.....	1	.....	1
Metropolitan	.....	.....	.....	.....	.....	.....	6	.....	6
Nash	.....	.....	.....	.....	1	12	47	14	74
Empire	.....	.....	.....	.....	1	1	.....	.....	2
Worthington disc	.....	.....	.....	1	.....	2	5	5	13
Thomson	.....	.....	.....	.....	.....	.....	1	2	3
Keystone	.....	.....	.....	.....	1	1	13	1	16
Gem	2	.....	.....	.....	.....	.....	.....	.....	2
Lambert	.....	.....	.....	.....	.....	1	1	3	5
Totals	3	1	10	28	34	63	141	154	434

TABLE XIV.

Meters Discontinued.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	.....	3	.....	8	7	10	20	58	106
Hersey	1	3	3	5	6	13	11	1	43
Hersey disc	.....	.....	.....	.....	4	6	10	15	35
Worthington	.....	1	2	5	5	6	4	.....	23
B. W. W	.....	.....	.....	.....	.....	.....	1	.....	1
Metropolitan	.....	.....	.....	.....	.....	2	10	.....	12
Nash	.....	.....	.....	.....	.....	1	10	.....	11
Worthington disc	.....	.....	.....	.....	.....	.....	1	.....	1
Thomson	.....	.....	.....	.....	.....	.....	1	.....	1
Gem	1	.....	.....	.....	.....	.....	.....	.....	1
Lambert	.....	.....	.....	1	.....	.....	.....	3	4
Totals	2	7	5	19	22	38	68	77	238

TABLE XV.

Meters Changed.

CAUSE.	Number.	CAUSE.	Number.
Test	398	*Brought forward*	811
Rust	6	Leak at body	11
Not registering	142	Clock broken	19
Gravel	9	Did not mesh	38
Solder	4	Piston broken	9
No force	74	Valve broken	1
Stoppage	55	Ratchet broken	10
Heat	2	Leak at coupling	14
Gasket	1	Piston bound	15
Enlarged	39	Leak at spindle	11
Relocated	11	Clock train stuck	9
Frost	13	Spindle shaft broken	5
Gear loose	3	Disc broken	6
Intermediate broken	50	Defaced	6
Gear bound	4	Total number	965
Carried forward	811		

TABLE XVI.

Meters Condemned.

	DIAMETER IN INCHES.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	.....	.....	.....	.....	.....	.....	2	13	15
Worthington	1	1	2	12	13	41	36	1	107
Metropolitan	.....	.....	.....	1	3	11	55	2	72
Hersey	.....	.....	.....	.....	.....	1	1	.....	2
B. W. W.	.....	.....	.....	.....	.....	.....	7	.....	7
Hersey disc	.....	.....	.....	.....	.....	.....	1	1	2
Ball & Fitts	.....	.....	1	.....	.....	.....	.....	.....	1
Totals	1	1	3	13	16	53	102	17	206

TABLE XVII.

Meters Purchased.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	1	.....	5	16	10	.....	.....	.....	32
Nash	.....	.....	.....	.....	6	84	117	24	231
Gem	2	.....	.....	.....	.....	.....	.....	.....	2
Hersey	1	.....	2	.....	.....	.....	.....	.....	3
Hersey disc	.....	.....	.....	.....	24	12	.....	40	76
Worthington disc	.....	.....	.....	18	.....	6	30	24	78
Keystone	.....	.....	2	1	2	2	27	3	37
Lambert	.....	.....	.....	.....	.....	24	24	.....	48
Totals	4	.....	9	35	42	128	198	91	507

TABLE XVIII.

Meters Repaired in Service.

Cause of Repairs.	Number.
Glass broken	53
Ratchet broken	4
Clock broken	67
Cover broken	44
Spindle broken	2
Gear broken	2
Spindle leaking	70
Coupling leaking	67
Pawl stuck	1
Gear loose	1
Clock loose	1
Defaced	2
	314

TABLE XIX.

Meters Repaired in Factory.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	.....	1	1	4	6	10	9	42	73
Hersey	.....	1	1	2	2	7	13	.....	26
Hersey disc	.....	.....	.....	.....	.....	.....	1	2	3
Empire	.....	.....	.....	.....	1	.....	1	.....	2
Gem	1	.....	.....	.....	.....	.....	.....	.....	1
Trident	.....	.....	.....	.....	.....	1	.....	.....	1
Nash	.....	.....	.....	.....	.....	.....	.....	1	1
Thomson	.....	.....	.....	.....	.....	.....	1	3	4
Lambert	.....	.....	.....	.....	.....	.....	.....	2	2
Totals	1	2	2	6	9	18	25	50	113

TABLE XX.

Meters in Service January 31, 1909.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	10	48	73	129	196	412	552	1,167	2,587
Worthington	.....	11	25	106	89	319	172	1	723
Hersey	11	15	42	136	169	274	371	19	1,037
Metropolitan	.....	.....	.....	.....	8	29	225	.....	262
Hersey disc	1	.....	6	7	74	76	108	130	402
B. W. W	.....	.....	.....	.....	.....	.....	21	.....	21
Lambert	.....	.....	.....	2	3	1	8	3	17
Nash	.....	.....	3	.....	4	62	116	22	207
Thomson	.....	.....	.....	.....	.....	.....	2	6	8
Gem	6	5	.....	1	.....	.....	.....	.....	12
Empire	.....	.....	.....	.....	7	5	2	.....	14
Trident	.....	.....	.....	.....	.....	2	.....	.....	2
Torrent	1	.....	.....	.....	.....	.....	.....	.....	1
Worthington disc	.....	.....	.....	2	.....	6	30	13	51
Keystone	.....	.....	2	.....	2	2	27	3	36
Totals	29	79	151	383	552	1,188	1,634	1,364	5,380

TABLE XXI.

Private Meters in Service January 31, 1909.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Worthington	.....	.....	2	5	3	8	3	11	32
Crown	6	3	2	5	19	9	4	32	80
Hersey	.....	3	2	1	2	3	.....	1	12
Gem	2	.....	.....	.....	.....	.....	.....	.....	2
B. W. W.	.....	.....	.....	.....	.....	.....	1	.....	1
Nash	.....	.....	.....	.....	.....	.....	.....	1	1
Hersey disc.	.....	.....	.....	.....	1	.....	.....	.....	1
Thomson	.....	.....	.....	.....	1	.....	.....	.....	1
Ball & Fitts	.....	.....	.....	1	.....	.....	.....	.....	1
Torrent	.....	1	.....	.....	.....	.....	.....	.....	1
Totals	8	7	6	12	26	20	8	45	132

TABLE XXII.

Meters at Department Shop January 31, 1909.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	2	3	6	9	5	6	9	48	88
Worthington	.....	7	3	8	5	30	24	2	79
Metropolitan	.....	.....	.....	1	1	4	26	.....	32
Hersey	1	3	2	4	5	4	10	1	30
Hersey disc.	.....	.....	1	.....	1	1	3	5	11
B. W. W.	.....	.....	.....	.....	.....	.....	1	.....	1
Lambert	.....	.....	.....	.....	.....	24	21	3	48
Rogers	.....	.....	.....	.....	.....	.....	1	.....	1
Nash	.....	.....	.....	.....	2	25	3	4	34
Ball & Fitts	.....	.....	.....	1	.....	.....	1	.....	2
Gem	1	1	4	1	.....	.....	.....	.....	7
Keystone	.....	.....	.....	1	.....	.....	.....	.....	1
Worthington disc.	.....	.....	.....	16	.....	.....	.....	11	27
Totals	4	14	16	41	19	94	99	74	361

TABLE XXIII.

Meters Belonging to Department January 31, 1909.

	Diameter in Inches.								Totals.
	6	4	3	2	1½	1	¾	⅝	
Crown	12	51	79	138	201	418	561	1,215	2,675
Worthington	.....	18	28	114	94	349	196	3	802
Hersey	12	18	44	140	174	278	381	20	1,067
Metropolitan	.....	.....	.....	1	9	33	251	.....	294
Hersey disc	1	.....	7	7	75	77	111	135	413
B. W. W	.....	.....	.....	.....	.....	.....	22	.....	22
Lambert	.....	.....	.....	2	3	25	29	6	65
Nash	.....	.....	3	.....	6	87	119	26	241
Thomson	.....	.....	.....	.....	.....	.....	2	6	8
Gem	7	6	4	2	.....	.....	.....	.....	19
Empire	.....	.....	.....	.....	7	5	2	.....	14
Trident	.....	.....	.....	.....	.....	2	.....	.....	2
Keystone	.....	.....	2	1	2	2	27	3	37
Torrent	1	.....	.....	.....	.....	.....	.....	.....	1
Ball & Fitts	.....	.....	.....	1	.....	.....	1	.....	2
Rogers	.....	.....	.....	.....	.....	.....	1	.....	1
Worthington disc	.....	.....	.....	18	.....	6	30	24	78
Totals	33	93	167	424	571	1,282	1,733	1,438	5,741

REPORT OF DISTRIBUTION DIVISION.

OFFICE OF THE SUPERINTENDENT,
710 ALBANY STREET, February 1, 1909.

WILLIAM E. HANNAN, ESQ.,
Water Commissioner:

SIR,— Following is the annual report of the Distribution Division for the year ending January 31, 1909:

ORGANIZATION.

From February 1, 1908, to March 26, 1908, the division was in charge of Assistant Water Commissioner James P. Lennon. Upon the latter date, the undersigned, Chief Clerk George H. Finneran, was placed in charge with the title "Official in Charge." The present organization is as follows:

Superintendent.—Chief Clerk George H. Finneran, acting in that capacity.
Assistant Superintendent (Northern Division).— Adam McClure.
Assistant Superintendent (Southern Division).— John W. Leahon.
Chief Clerk.— George H. Finneran.
11 clerks.
2 messengers.
2 janitors.
6 inspectors of work.
Machine Shop.— Foreman, Edward J. Bachelder.
23 machinists, helpers, etc.
5 blacksmiths and helpers.
1 engineman.
1 fireman.
1 patternmaker.
1 patternmaker's helper.
Carpenter Shop.— Foreman, Richard F. Neagle.
9 carpenters.
Plumbing Shop.— Foreman, B. F. Rogers.
14 plumbers, electricians and helpers.
3 laborers (trough cleaners).
Storeroom.— Storekeeper, John W. Sullivan.
3 assistants.
Main Yard (Albany Street).— Foreman, John J. Maguire.
34 yardmen.
23 teamsters and drivers.
11 stablemen.
6 painters.
7 concrete boxmakers and helpers.
5 men in yard storehouse.
Gate and Hydrant Inspection.— Foreman, Samuel J. Hallett.
21 men.
Main Pipe Gangs.
Foreman Doherty and 18 men.
Foreman Durand and 15 men.
Foreman McCarthy and 23 men.

Central District.— Repairers and service pipe men. Foreman, William T. Lenehan.
2 sub-foremen.
40 repairers.
10 service pipe men.
10 watchmen and night emergency men.
Brighton District.— Foreman, Thomas Neville.
13 men in Brighton yard.
4 men at Brookline reservoirs.
Charlestown District.— Foreman, Patrick Kelly.
21 men.
Dorchester District.— Foreman, Timothy Casey.
15 men.
East Boston District.— Foreman, William F. O'Donnell.
19 men.
West Roxbury District.— Foreman, Thomas C. McDonald.
22 men.
Parker Hill Reservoir.— 2 men.

This makes a total of **421** men in the division. One year ago the total number of men was **486.** The average number of men at work daily during the year was **401.** The average number of men absent daily during the year was **39.** The average age of the men now in service is **52.2** years, and the average number of years of service per man is **15.3** years.

MAIN PIPE.

During the year **57,527** linear feet of mains were laid, relaid and relocated; and **25,496** linear feet were abandoned, and either taken from the ground or left therein, as conditions warranted. Gate valves, air valves and blow-offs were established and abandoned as stated in Table No. 1 appended to the text. The total mileage of mains now owned and operated by the department is **753.17,** consisting almost entirely of cast-iron pipe, there being 4,985 feet of 30-inch, and 6,180 feet of 20-inch wrought-iron, cement lined pipe in the system.

Of the amount laid, 554 feet of 6-inch, 10,767 feet of 8-inch, 2,739 feet of 10-inch and 5,513 feet of 12-inch were laid to supply new buildings in streets where water mains had not been laid, and high service to buildings in the business section.

Replacing old and inadequate mains, there were laid: 86 feet of 20-inch; 3,891 feet of 16-inch; 7,170 feet of 12-inch; 2,843 feet of 10-inch; 2,020 feet of 8-inch; 1,610 feet of 6-inch; and 54 feet of 4-inch.

On account of the abolishment of grade crossings in East Boston, and the operations of the Sewer, Bridge and State Highway Departments, the Boston Elevated Railway Company and the Boston Transit Commission, it was necessary to relocate the following lengths of main pipe: 125 feet of

36-inch; 283 feet of 30-inch; 220 feet of 20-inch; 141 feet of 16-inch; 4,985 feet of 12-inch; 184 feet of 10-inch; 287 feet of 8-inch; and 68 feet of 6-inch.

From a distribution standpoint the most important work was that of laying the 48-inch line in Longwood avenue, between Brookline avenue and parkway; the 20-inch line in Gates and Dorchester streets, South Boston; and the 12-inch and 4-inch submerged lines in Boston Harbor between Moon and Long Islands, and Long and Rainsford Islands, respectively; the replacement of the 6-inch, 8-inch and 12-inch mains in First and Dorchester streets with 16-inch; the 12-inch main in Chelsea street, East Boston, with 16-inch; the 12-inch main in Dover street with 16-inch; the 6-inch mains in Magnolia, Wayland, Parkman, Gibson, Clarendon, Corning and Batterymarch streets and Massachusetts avenue with 12-inch and 10-inch; the 8-inch main in Kilby and Congress streets with 12-inch; and about 1,650 feet of 2-inch, 3-inch, and 4-inch mains, in several of the streets and courts in the Charlestown district, with 6-inch.

The construction of that part of the 48-inch line in Longwood avenue, between Brookline avenue and parkway, completed the line planned to extend from Tremont street at Prentiss street to Beacon street at Coolidge's corner. The section between Tremont street and Muddy river in the parkway was laid by the Boston Water Department, and the section between Muddy river and Beacon street was laid by the Metropolitan Water and Sewerage Board. Connections are now made with the 30-inch and 36-inch low service mains in Tremont street at Prentiss street; the 16-inch low service main in Huntington avenue at Longwood avenue; the 40-inch and 12-inch low service mains at Brookline and Longwood avenues; and the 48-inch low service main in Beacon street at Coolidge's corner. It is planned by the Metropolitan Water and Sewerage Board to extend this line next year from Coolidge's corner to Chestnut Hill Reservoir by way of Beacon street, thus giving the city another direct supply line, and relieving it to a great extent from a possibly embarrassing position in the event of the shutting off of one or both 48-inch lines now leading from Chestnut Hill to the city. It is only good fortune that has spared the city thus far from a situation that is not at all beyond likelihood, resulting from the breaking of the Beacon street 48-inch, the Clinton road 48-inch, and the very precarious 30-inch line crossing the Charles river at Warren Bridge. This combination of accidents together with a large fire would produce an effect that would be serious, to say the least. The completion and operation of the Tremont street

Coolidge's corner 48-inch line has already produced beneficial results, a gain in head of about 10 feet being realized in the Back Bay and western section of the city, and pressures generally in the low service of the city proper are more equalized and better balanced.

On Telegraph Hill, South Boston, upon which was formerly located the South Boston Reservoir, the 20-inch low service supply by way of Dover and Fourth streets, and the 20-inch low service supply by way of Dudley street, Columbia road and Dorchester street, meet and merge. At times in the past, however, because of a reduction in the head due to unusual draught, the flow in these two mains has been unable to surmount the summit of the hill in quantity to be of practical value. Hence, they did not reinforce each other, and the supply in South Boston suffered accordingly. This has now been remedied by a connection of the two mains at a grade sufficiently low to insure under all ordinary fluctuations in the pressure a union under good head of the two supplies. The connection consists of a 20-inch main extending from Telegraph street, at Gates street, through Gates and Dorchester streets to Fourth street, where it joins the 20-inch line at that point. South Boston will not, however, be assured of anything approaching an adequate and unfailing supply until a feed is brought into the district by way of Congress street. This will be realized, it is hoped, the coming year, when the uncompleted section of a new 30-inch line is laid in Congress street between Atlantic avenue and Congress Street Bridge, and the proposed loop of 30-inch pipe is laid in Sleeper street, Northern avenue and C street.

Ever since 1888, when the system was extended to the islands in the harbor, the department has been dependent upon one line of submerged pipe between Moon and Long Islands. This was a 6-inch line, and in 1895 it froze and became hopelessly defective. Service was maintained by a temporary 2-inch lead pipe until another 6-inch line was laid in the same year. The frozen 6-inch and the 2-inch temporary pipes were then abandoned, and the new 6-inch line has since been the only means of supply for Long, Rainsford, George's and Gallop's Islands, until the latter part of the present year, when a new 12-inch flexible jointed pipe was laid between Moon and Long Islands and the water turned into the same. The 6-inch line is also in service and by connections on Long Island and the manipulation of gate valves in same, it is made to serve Rainsford Island only, while the new 12-inch serves Long, George's and Gallop's Islands. This division of duty insures a sufficient velocity in both pipes to keep the water

from freezing. At the same time that the 12-inch line was laid between Moon and Long Islands, a 4-inch flexible jointed line was laid between Long and Rainsford Islands, thus giving us a much needed connection between these two points. The old line had suffered much by the action of the tide, dragging anchors, and other submarine disturbances, and, as a consequence, was frequently out of service. A 2-inch lead pipe had been serving as an auxiliary supply, but, of course, was insufficient. We are now quite secure against adverse contingencies with two 4-inch and one 2-inch lines.

In First street, South Boston, between D and Dorchester streets, the 6-inch and 8-inch mains were replaced by a 16-inch main, thus giving that section, which is rated as a dangerous fire district, an ample supply. The new main connects indirectly with the 30-inch feed main in D street, and in Dorchester street it continues from First to Third streets, where connection is made with the 20-inch that extends through Third street to Q street, there reducing to a 16-inch, and continuing through Q street, the Strandway, Columbia road and Vale street to Dorchester street, where it unites with the 20-inch main in that street, thus forming a loop line around the edge of the peninsula and reinforcing the supply at those extreme points where a loss of head is ordinarily to be expected.

The 12-inch main in Chelsea street, East Boston, was partly relaid with 16-inch between Maverick square and Putnam street, thus making a start in a broad scheme of strengthening the fire service in the island and renewing the mains which are in many cases over fifty years old and in bad condition.

By laying a short stretch of 16-inch high service pipe in Dover street across Washington street, and making connections at that point at Harrison avenue, and opposite the bath house, a piece of 16-inch high service main, 365 feet long, that had been lying dead in the ground for three years, was made available, and completes a section, 450 feet long, of the proposed 16-inch high service main, which is intended to replace the 12-inch high service main in Dover street, between Columbus avenue and Fort Point channel, thereby increasing the South Boston high service supply.

In Magnolia and Wayland streets, Dorchester, the 6-inch mains were replaced by 12-inch mains, and the beginning of a general enlargement of the pipes in that section made.

In Parkman and Gibson streets, Dorchester, the 6-inch mains were replaced by 12-inch and 10-inch mains, respectively. These mains connect the Dorchester avenue and Adams street mains and aid materially in furnishing a better fire service in a section where it is much needed.

The enlargement of the 6-inch mains in Clarendon street, between Warren avenue and Columbus avenue, Corning street, between Shawmut avenue and Washington street, and Massachusetts avenue, between Washington and Tremont streets, to mains of 12 inches in diameter, furnishes in the South End district additional cross connecting lines of good capacity, which equalize the flow and conduct the supply in ample quantity to points of large consumption.

Kilby street, between Milk and State streets, was to be resurfaced and we took advantage of the same to relay the old 8-inch with 12-inch, thus bringing the size of pipe in that street up to a proper standard for the business district.

As the 6-inch main in Batterymarch street was in a very bad condition from corrosion and tuberculation, it was relaid with a 10-inch main, thereby increasing its capacity and raising it to the required standard for a down-town main.

COST OF MAIN PIPE WORK.

The following is a statement of the direct costs of the main pipe work performed during the year, with explanatory notes and a statement preceding it of prices upon which said costs are based:

Prices.

Main pipe, 3 inches to 42 inches, inclusive, at	$0.0116 lb.
" 48 inches, at	.01115 lb.
" specials, small, at	.0285 lb.
" " large, at	.025 lb.
Gate valves, 3 inches, at	14.73 each.
" 4 inches, at	16.71 each.
" 6 inches, at	24.86 each.
" 8 inches, at	31.69 each.
" 10 inches, at	46.59 each.
" 12 inches, at	53.83 each.
" 16 inches, at	112.10 each.
" 20 inches, at	287.19 each.
" 24 inches, at	329.23 each.
" 30 inches (with 6-inch by-pass), at	568.59 each.
" 36 inches (with 6-inch by-pass), at	808.59 each.
Gate-valve boxes, small, wood, at	3.79 each.
" " " concrete, at	7.24 each.
" " large, wood, at	4.72 each.
" box frames and covers, at	.0225 lb.
Lead, at	.0445 lb.
Gasket, at	.06 lb.
Blocking, at	.019 feet.*
Clay, at	.0034 lb.
Firewood, at	.79 ft.
Cartage, short haul, at	.82 ton.
" long haul, at	1.42 ton.
Single team (department), at	3.00 day.
Double team (department), at	5.00 day.
" (hired), at	6.00 day.

* B. M.

NEW MAINS.

Forty-eight Inches in Diameter.

912 feet laid at a total cost of $17.36 a linear foot.
9 feet laid at a total cost of $27.83 a linear foot.

The 912 feet laid at a total cost of $17.36 a linear foot was first let out by contract. The contractor assumed to excavate, backfill, haul the pipes and specials from the yard at 710 Albany street, lay them in the trench, run and calk the joints, and furnish all necessary appurtenances and materials, except the pipes, specials and lead, all for $1.95 per linear foot. The contractor laid 624 feet, when by reason of his exceeding the time limit and his apparent inability to finish the work, the job was taken from him and finished by the department. From the point where the department took up the work many difficulties were encountered. A section of 12-inch water main, 179 feet long, had to be removed from the line of the 48-inch, and relaid upon a bench in the southerly bank of the trench. At Autumn, Plymouth and Bellevue streets, the mains of these streets were raised or lowered as the case might be to allow for the passage of the 48-inch. The Longwood avenue 12-inch main at these points had to be relocated accordingly, so that in all there were 225 feet of 12-inch, 6 feet of 10-inch, and 12 feet of 8-inch mains relaid on account of the 48-inch main. At two different points catch-basin connections crossed the trench and, as they could not be raised, the 48-inch had to be lowered, so that for a distance of about 200 feet it was necessary to excavate a trench about 13 feet in depth. The material was a spongy clay that froze during the cold weather, and when the early thaws came caused no end of trouble. On account of the unstable consistency of the filling the trench had to be "horsed off" from traffic until the clay dried somewhat, and even then it was necessary to remove about a foot depth of the same and replace it with crushed stone and binding gravel and roll it with a road roller. Leaks developed when the water was turned into the new main and several excavations had to be made at points where it was thought they existed, but beyond a few joints that were somewhat "loose" no serious defect was found. Incidental to the search for these leaks we discovered a section of about 50 feet of vitrified pipe sewer broken and stopped by gravel. As this sewer ran along in the northerly bank of our trench, it was without doubt broken by settlement and a lateral movement due to insufficient sheathing on the part of the contractor. The department performed the excavation and backfilling and the Sewer Division relaid the sewer. All these conditions, together with the fact that the department's share of the work was done during the winter, contributed to the apparent high cost of the job. Two very valuable, though somewhat old, lessons are borne home to the department with positive emphasis as a result of our experience with this work; one, that the lowest bid does not always prove to be the cheapest, and the other, that it is almost folly to carry on a job of this kind during the winter by day work.

The 9-foot job was laid by the Metropolitan Water and Sewerage Board and the Boston Water Department combined, and was part of a connection between the Boston Water Department's 48-inch main in Beacon street, at Coolidge's corner, and the new 48-inch line laid by the Metropolitan Water Board in Longwood avenue and Harvard street, Brookline. Although the latter main is intended to continue through Beacon street to the reservoir, it was considered advisable to utilize the portion laid by a temporary connection, as stated. The work, which consisted of setting a 48-inch 3-way branch,

had to be done upon a Sunday with consequent extra pay for the men. The Metropolitan men did the digging and backfilling and the pipe work, and the Boston men assisted by closing the gates and emptying the line, and, after the work was completed, by reversing the operation. Connections are always more or less expensive and this job was no exception to the rule.

Thirty-six Inches in Diameter.

20 feet laid at a total cost of $27.83 a linear foot.

This was a part of the connection referred to in the foregoing paragraph (48-inch) and the same conditions applied here as there.

Twenty Inches in Diameter.

940 feet laid at a total cost of $6.70 a linear foot.

This was the line laid in Gates and Dorchester streets, South Boston. The Hub Construction Company performed the excavating and backfilling for $1.10 per cubic yard. The Water Department laid and jointed the pipes. There was a cut of about 13 feet at the junction of Gates and Telegraph streets. Two brick gate-valve chambers of unusual depth had to be built at that point, and an expensive bitulithic and granite block, pitch and pebble pavement had to be relaid in Dorchester street at a cost of $853.30. Three 20-inch gate valves were set in the line and numerous house drains were encountered and relaid. These conditions caused a rather expensive job.

Twelve Inches in Diameter.

(*a.*) 590 feet laid at a total cost of $1.43 a linear foot.
(*b.*) 667 feet laid at a total cost of $1.46 a linear foot.
(*c.*) 3,244 feet laid at a total cost of $2.08 a linear foot.
(*d.*) 885 feet laid at a total cost of $2.58 a linear foot.
(*e.*) 641 feet laid at a total cost of $4.53 a linear foot.
(*f.*) 165 feet laid at a total cost of $4.71 a linear foot.
(*g.*) 218 feet laid at a total cost of $5.21 a linear foot.
(*h.*) 3,231 feet laid at a total cost of $6.41 a linear foot.
(*i.*) 92 feet laid at a total cost of $12.58 a linear foot.

(*a.*) Laid through the grounds of the Consumptives' Hospital in Mattapan. The digging, backfilling and lowering of pipe into trench was done by a contractor in the employ of the hospital. The Water Department furnished the pipe and specials, lead, gasket, wood and blocking, and jointed the pipes.

(*b.*) Laid by the Metropolitan Water and Sewerage Board on account of the construction of the Metropolitan sewer through Washington street, Brighton. The Boston Water Department furnished the pipe and specials, the labor of inspection, and reconnected the service pipes. The Metropolitan people did the digging, backfilling, laying and jointing of the pipe, and furnished the lead, gasket, wood and blocking.

(*c.*) This work consisted of four jobs done by contract under the specifications usually employed, viz.: the contractor digs, backfills, lowers the pipe, and makes the joints, and the Water

Department furnishes the pipe, specials, lead, gasket and blocking. None of these jobs was in what could be termed "congested territory," although one of 923 feet was upon a wharf where dock mud, water, old timbers and a railroad crossing were encountered.

(*d.*) This represents the cost of work done entirely by the department in five different places, all of which were out of town in free and unobstructed trenches.

(*e.*) This is one job done entirely by the department in down-town streets, where conditions were about as bad as could be. The pipe was laid close to the edgestone of the sidewalk and it was necessary to carry it around several catch-basins. It crossed Eliot street at Tremont street, where all kinds of underground pipes and conduits were in the way, and at Seaver place it crossed Tremont street, passing under and over, as conditions warranted, two 30-inch water mains, one 12-inch water main, two gas mains, a telephone conduit, an electric light conduit, the street railway conduit, and the arch of the subway, which had to be cut away. In Hollis street the asphalt had to be replaced at a cost of $157.13. Bridging had to be done almost continuously to facilitate travel, and many specials with an increased number of joints were required.

(*f.*) Laid by department in rock during the winter. Our work was cut up and obstructed by reason of the presence of rock.

(*g.*) Partly laid over bridge where additional expense was involved by the construction and painting of a box around the pipe, and fenders upon the bridge to protect the box. Another job is included in this average, where the pipe was laid through a stone culvert and considerable masonry was necessary.

(*h.*) Laid by contract under water in Boston Harbor. Not only were the conditions unusual but the flexible joint pipe used was much more expensive than the ordinary pipe used on land, it costing $38.40 a ton. More lead is used in the joints of this kind of pipe and conditions are in every way more expensive.

(*i.*) Composed of connections where the amount of work done and the expensive stock used, such as branches, gates, etc., are greatly out of proportion to the length in feet. There is considerable waste of time in these jobs, caused by notifying before shutting off, shutting off and letting on, interruption by car and other traffic, and the impracticability of working all the time the full force of men required upon the job.

Ten Inches in Diameter.

(*a.*) 2,535 feet laid at a total cost of $2.08 a linear foot.
(*b.*) 2,935 feet laid at a total cost of $2.04 a linear foot.

(*a.*) Department work under good conditions. No paving. No congestion.

(*b.*) Contract work in outlying sections. Conditions good. No obstructions. Very little rock.

Eight Inches in Diameter.

(*a.*) 1,518 feet laid at a total cost of $1.44 a linear foot.
(*b.*) 6,329 feet laid at a total cost of $1.88 a linear foot.
(*c.*) 3,251 feet laid at a total cost of $2.47 a linear foot.
(*d.*) 73 feet laid at a total cost of $5.83 a linear foot.

(*a.*) Contract work. Two jobs. Both in suburbs. Conditions excellent.
(*b.*) Department work in uncongested streets. Conditions good.
(*c.*) Department work where rock in varying quantity was encountered.
(*d.*) Department work. Connections. Winter work. Car tracks.

Six Inches in Diameter.

(*a.*) 1,068 feet laid at a total cost of $1.51 a linear foot.
(*b.*) 572 feet laid at a total cost of $1.60 a linear foot.

(*a.*) Contract work. Nine hundred thirty feet laid on islands in harbor. Difficulty in transportation, etc. One hundred thirty-eight feet laid in city street includes service pipe connections.
(*b.*) Department work. Composed of seven small jobs where cost is disproportionately large.

Four Inches in Diameter.

(*a.*) 140 feet laid at a total cost of $4.22 a linear foot.
(*b.*) 3,534 feet laid at a total cost of $4.64 a linear foot.

(*a.*) Contract work. Laid in shores of Long and Rainsford Islands. Tide interference and difficult transportation.
(*b.*) Contract work. Submerged pipe in Boston Harbor, between Long and Rainsford Islands. Pipe cost $41.50 a ton.

REPLACEMENT OF OLD MAINS.

Twenty Inches in Diameter.

86 feet laid at a total cost of $7 a linear foot.

This was laid upon supports between bridge girders on Boston & Albany Railroad Bridge, Massachusetts avenue, near Boylston street. It replaced a 24-inch riveted steel pipe badly corroded. Supporting timbers had to be covered with tin as a protection from hot cinders from locomotives. Abutments had to be removed and rebuilt and asphalt on both sides relaid. Particularly difficult job, with interruptions from passing trains.

Sixteen Inches in Diameter.

(*a.*) 1,370 feet laid at a total cost of $2.48 a linear foot.
(*b.*) 2,419 feet laid at a total cost of $5.49 a linear foot.
(*c.*) 102 feet laid at a total cost of $8.23 a linear foot.

(*a.*) Two contract jobs in Chelsea street, East Boston, done in early winter. Both stopped by bad weather; one nearly finished, the other about one-third finished. Department will have to finish the latter. Cost as stated includes only finished work, except that very likely some repaving will be necessary in the spring. There were many service connections to be transferred from old to new mains, and several hydrants set.
(*b.*) Department work in First and Dorchester streets, South Boston. Done in winter. Frost in ground. Had to use thawing machine. Many services and branches were recon-

nected. Repaving cost $1,098.97. Many delays occasioned by accommodating manufacturers in shutting off, preparatory to breaking out. Generally hard job done under unfavorable conditions.

(*c.*) Department work. Two jobs. Both in car tracks. The larger one (89 feet), at junction of Dover and Washington streets, where interruption was incessant and underground conditions very bad. Small holes had to be dug and back-filled one at a time. The smaller one, a connection with special castings.

Twelve Inches in Diameter.

(*a.*) 5,373 feet laid at a total cost of $2.11 a linear foot.
(*b.*) 227 feet laid at a total cost of $2.59 a linear foot
(*c.*) 393 feet laid at a total cost of $3.67 a linear foot.
(*d.*) 347 feet laid at a total cost of $4.00 a linear foot.
(*e.*) 736 feet laid at a total cost of $5.10 a linear foot.
(*f.*) 94 feet laid at a total cost of $8.16 a linear foot.

(*a.*) Contract work. Department furnished pipe and specials, lead, gasket and blocking, and made the service and main-pipe connections; contractor did the excavating, backfilling, laying and jointing. This work was done in streets like Clarendon, Corning, Parkman (Dorchester), Wayland and Magnolia and Massachusetts avenue. Branch connections were frequent, services were many and "shut downs" were necessarily short while breaking out and laying new sections. It was typical "relaying" work with conditions sufficiently varied to make it a good basis for comparison. There was only one repaving item, that in Corning street, which was $77.62 for a concrete base under an asphalt top. The asphalt top was not charged to the department.

(*b.*) Department work. One job only in Erie street, Dorchester. Ordinary conditions.

(*c.*) Department work. Old pipe was laid shallow. Trench had to be "bottomed." Rock taken out by day work. Temporary main upon bank of trench was laid to supply consumers while blasting and "bottoming" was in progress. The job was stopped several times by unavoidable causes.

(*d.*) Department and contract work mixed. Department laid pipe, jointed same and reconnected services. Contractor excavated, backfilled and repaved. He was paid on a 15 per cent basis. Job was in Congress street, between State and Water streets. Congestion and general conditions very bad. Four branch connections with side streets. Bridging necessary at several points. Extra attention necessary in confining excavated material to small space. Car traffic a factor in delay.

(*e.*) Department work. Brimmer, Kilby and Water streets. Usual down-town conditions, especially in Kilby street. Shutting off water while connections were being made objected to by consumers. Deference to their protests caused delay. Asphalt pavement cost $350.88, which does not include cost of concrete base in Kilby and Water streets laid by department at a cost of about 28 cents a linear foot of trench. Trench had to be thoroughly rammed on account of immediate surfacing with asphalt. Extra amount of teaming.

(*f.*) Department work. Connections in down-town congested streets. Large proportion of specials used, with consequent extra expense. Night work with extra rate of pay.

Ten Inches in Diameter.

(*a.*) 1,239 feet laid at a total cost of $1.75 a linear foot.
(*b.*) 535 feet laid at a total cost of $3.10 a linear foot.
(*c.*) 860 feet laid at a total cost of $3.34 a linear foot.
(*d.*) 25 feet laid at a total cost of $5.14 a linear foot.
(*e.*) 175 feet laid at a total cost of $5.75 a linear foot.
(*f.*) 9 feet laid at a total cost of $8.14 a linear foot.

(*a.*) Contract work. Macadam streets. Good conditions. No expensive conditions. Usual specifications.
(*b.*) Department work. Suburban streets. Done in winter. Car tracks in one job. Bad weather. Hard digging. Irregular attendance of men with consequent inconvenience in carrying along the work.
(*c.*) Contract work. Batterymarch and Wendell streets. Connections had to be made by department after hours for convenience of consumers. Additional gates had to be set to facilitate connections and street had to be repaved at a cost of $355.84.
(*d.*) Department work. Connection including gate. Obstructions and interference. Asphalt and concrete base.
(*e.*) Department work. Connections and short sections of relaying. Disproportionate amount of specials and some rock.
(*f.*) Department and contract work mixed. Contract work on a 15 per cent basis. Job in Congress square at Congress street. Highly congested. Repaving and all the obstacles that go with down-town work.

Eight Inches in Diameter.

(*a.*) 953 feet laid at a total cost of $1.48 a linear foot.
(*b.*) 517 feet laid at a total cost of $1.87 a linear foot.
(*c.*) 296 feet laid at a total cost of $2.31 a linear foot.
(*d.*) 57 feet laid at a total cost of $4.04 a linear foot.
(*e.*) 197 feet laid at a total cost of $4.07 a linear foot.

(*a.*) Contract work under generally good conditions. No paving or extra expense. Several branch connections and a little delay due to gas pipe lying in our trench.
(*b.*) Department work under generally good conditions. No paving or extra expense. In outlying districts.
(*c.*) Department work in macadam street, free of obstacles. Work done in winter. Includes expense of maintaining trench as it settled in "soft" weather.
(*d.*) Department work in congested streets (Doane street and Exchange place). Gate valves and branches used, and asphalt and concrete base.
(*e.*) Department work. Chiefly connections. Done in winter. Composed of seven small jobs. Stock cost disproportionately large.

Six Inches in Diameter.

1,610 feet laid at a total cost of $1.70 a linear foot.

Nine jobs, all done by department in Charlestown district, replacing pipes of 2-inch, 3-inch and 4-inch diameter. Jobs

located in narrow streets and courts, or places where it was difficult to handle the pipe and care for the excavated material. Considerable "wheelbarrow" work and much relocation and regulation of services.

Four Inches in Diameter.

54 feet laid at a total cost of $1 a linear foot.

Similar in every respect to the 6-inch work described in preceding paragraph.

RELOCATION OF MAINS.

Thirty-six Inches in Diameter.

125 feet laid at a total cost of $2.03 a linear foot.

Trench work by Sewer Division. Same pipe used. Raised from 0 to 6 inches by springing line upward with lifting screws and redriving joints. Considerable delay by reason of Sewer Division not having trench excavated properly. Blow-off connection with sewer had to be severed and afterward reconnected in a different way. Line had to be emptied between Roxbury Crossing and Massachusetts avenue. Work done on Sunday with extra rate of pay.

Thirty Inches in Diameter.

(*a.*) 125 feet laid at a total cost of $2.03 a linear foot.
(*b.*) 158 feet laid at a total cost of $9.19 a linear foot.

(*a.*) Similar in every respect to the 36-inch job described in preceding paragraph. Both lines were parallel to each other in the same trench.
(*b.*) Trench work by Boston Elevated Railway Company. New line of pipe laid with a 16-inch and a 12-inch; all three laid side by side. Connections made on Sundays, and after hours, with extra cost thereby.

Twenty Inches in Diameter.

(*a.*) 110 feet laid at a total cost of $6.03 a linear foot.
(*b.*) 110 feet laid at a total cost of $6.70 a linear foot.

(*a.*) New line of pipe on bridge over Boston & Albany Railroad. Pipe suspended from I-beams. Considerable abutment work. Delayed and interrupted by other corporations at work at same time and place. Connections made underground at both ends of bridge.
(*b.*) Excavating and backfilling done by contract at $1.10 a cubic yard. Remainder of work done by Water Department. Pipe lowered by means of curves to grade of new 20-inch line in Gates street with which it connects. A cut of about 13 feet was necessary and practically all new stock. A 20-inch gate valve with brick chamber is included in the cost and all the curves were set-screwed.

Sixteen Inches in Diameter.

141 feet laid at a total cost of $4.01 a linear foot.

Conditions same as (*b.*) under "Thirty Inches."

Twelve Inches in Diameter.

(*a.*) 175 feet laid at a total cost of $1.43 a linear foot.
(*b.*) 557 feet laid at a total cost of $2.00 a linear foot.
(*c.*) 3,050 feet laid at a total cost of $2.60 a linear foot.
(*d.*) 183 feet laid at a total cost of $3.58 a linear foot.
(*e.*) 795 feet laid at a total cost of $4.27 a linear foot.

(*a.*) Metropolitan Water Board furnished lead, gasket, wood and blocking and laid all the pipe.
(*b.*) Department work composed of eight jobs of varying extent, where mains were raised, lowered, offsetted, or temporarily removed to allow of operations of Sewer Division. Old stock used in some cases, but in all cases special castings were necessary.
(*c.*) Contract work under usual specifications. Some extras on account of unforeseen conditions. Solid rock encountered in one portion of work and broken rock of inconvenient size in another. The work practically same as laying new mains and typical of extension in the outlying sections, where soil conditions are composite.
(*d.*) Conditions same as (*b.*) under "Thirty Inches."
(*e.*) Department work where pipe was relocated to allow of construction and changes in bridge structures over which our mains run. Although there was not much digging aside from that at the abutments, nevertheless the difficult conditions and complications involved made the cost high. In three jobs aggregating 569 feet boxes had to be built covering the pipes. Including the fenders and painting these are expensive. Stonework was also necessary in the abutments.

Ten Inches in Diameter.

(*a.*) 55 feet laid at a total cost of $3.40 a linear foot.
(*b.*) 103 feet laid at a total cost of $3.58 a linear foot.
(*c.*) 20 feet laid at a total cost of $7.64 a linear foot.

(*a.*) Department work done on account of sewer construction. Pipe had to be raised, removed and put back. Large proportion of special castings used.
(*b.*) Contract work. Connections. Rock.
(*c.*) Department work. Connections. High ratio of special castings used with consequently greater expense per foot.

Eight Inches in Diameter.

(*a.*) 185 feet laid at a total cost of $2.24 a linear foot.
(*b.*) 90 feet laid at a total cost of $3.77 a linear foot.

(*a.*) Relocated on account of change in grade due to abolishment of grade crossing. Steam railroad track ran close to edge of

trench. Only small sections of trench could be opened at a time and would then have to be backfilled before another section could be opened. Much bracing was necessary.

(*b.*) Several small jobs of raising and offsetting on account of sewer construction.

Six Inches in Diameter.

68 feet laid at a total cost of $3.02 a linear foot.

Several small jobs of offsetting, raising, etc.

Independent of main pipe work, the following gate valves, air valves and blow-offs were established on old mains at the costs stated.

Gate Valves.

3	16-inch, total cost	$547 32
13	12 " "	1,232 41
1	10 " "	79 00
5	8 " "	355 39
4	6 " "	391 33
1	4 " "	56 24

Air Valves.

1	2-inch, total cost	$26 17
2	1½ " "	62 14

Blow-Offs.

1	6-inch, total cost	$101 31
3	4 " "	210 01

Blow-Offs Extended.

1	12-inch, total cost	$193 11

The following gate valves, air valves and blow-offs were abandoned in one location and established in another at the costs stated.

Gate Valves.

2	16-inch, total cost	$323 02
2	12 " "	79 96
1	6 " "	79 45

Air Valves.

2	2-inch, total cost	$35 40

Blow-Offs.

1	6-inch, total cost	$75 97

The total cost of repairs and maintenance of main pipes for the year was $22,161.75. This includes not only the cost of repairing leaks in the mains, but also the cost of inspecting and preventing leaks, and such work as "blowing

off" dead ends, thereby clearing the pipes of rust, sediment and other accumulations; marking the locations of gate valves; salting the covers of boxes inclosing gate valves, air valves and blow-offs when snow and ice covered the ground; testing, oiling, and otherwise inspecting gate valves, air valves and blow-offs; repairing, renewing and regulating the boxes, frames and covers for the same; inspecting openings and operations of other corporations and departments with the object of protecting our mains from injury or other detriment; repaving and repairing the streets where repairs had previously been made; in general, all work that was related to the efficiency and good condition of the main pipes. The above amount might be divided, however, as follows: $11,445.37 representing the cost of repairing defects in the pipes and valves; $7,233.09 representing the cost of repairs, renewals and regulations of the valve boxes and street repairs; and $3,483.29 representing the cost of inspection, testing, marking, etc.

Exclusive of "Bad Water," which necessitated blowing off dead ends **351** times, "Defective Gates" was the most prevalent cause of trouble in the mains, there being **154** cases, mostly due to loose packing. "Leaking Joints" came next with **143** cases. "Settlement" next with **35** cases. "Broken" and "Burst" pipes next with **21** cases; these usually were due to imperfect castings or deterioration of the pipes, combined with fluctuating pressure and water ram, and as a rule proved to be the most serious in consequences. **Sixty-seven** cases were of miscellaneous causes. Altogether there were **769** defects repaired in the mains and valves; **1,382** box repairs, renewals, regulations and street repairs; and **11,762** marking, testing, oiling, salting and inspecting jobs.

Repairs in the main pipe system are yearly becoming more expensive for the same reason that the work in general of the distribution system is becoming more expensive, viz., the increasing congestion below and above the surface of the streets, and the increasing number of streets having asphalt, bitulithic, wooden block and granite block pavements laid upon a concrete base.

Water damage from leaks and breaks is also becoming a most important factor, due no doubt to the increasing tendency of the public towards litigation upon the slightest pretext. In former years it was only upon the occasion of extraordinary damage that a claim was made, but now it seems as if a great many people were awaiting an opportunity upon which to base a claim, and in estimating the amount of damages the tendency is decidedly towards overestimat-

ing rather than underestimating, with the excess ranging from 50 per cent upwards. It is therefore necessary in the event of a leak or break in the main or other fixture that the employees of the department be upon the scene at the earliest possible moment and shut off the water, thus minimizing the possible damage. Although the department is at present equipped in its central district with an emergency wagon and crew, on duty at all hours of the day and night, nevertheless, a bad break in any of the outlying districts, where only a watchman is at hand, would find it at a disadvantage. As a means of improvement in this important matter I would recommend the substitution of an automobile for the present horse-drawn wagon at the central yard in Albany street. With such a rapid means of conveyance the emergency crew at Albany street could arrive upon the ground in a very short time, and after working hours, or, for that matter, during any part of the day, when necessary, could cover the whole city without much trouble. This branch of the department to be of value must be conducted with regard to promptness, discipline and efficiency, and upon practically the same basis as the Fire Department.

Referring to the causes of leaks I find that many of the cases of "Leaking Joints" were due to vibration caused by the passage through the streets of the new type of semi-convertible trolley car, weighing about thirty tons. These extra heavy cars produce a jar that loosens the joint. Along the line of our cement pipe the effect is particularly injurious, the cement appearing to crack and disintegrate from the vibration. As this type of large and heavy car will probably increase in number throughout the city and eventually become general, a rather serious situation is before us. Some study should be given the question to determine the best manner of meeting it.

In the railroad yards at South Boston and Charlestown, where our pipes pass under the tracks, we are troubled with a considerable number of leaks, due also to vibration caused by the cars upon the tracks above. Either our pipes should be removed or else laid within a sheath or envelope consisting of a larger pipe. We have recently tried laying a flexible jointed pipe under a railroad track in Charlestown. It is the same pattern of pipe laid under water and we are observing the result with interest.

One of the most expensive jobs in connection with the maintenance of main pipes was the repairing and rebuilding of the boxes covering the 30-inch, 20-inch and 16-inch lines crossing the Charles river at Warren Bridge. These large

boxes were practically rebuilt with two-inch matched spruce and given two coats of paint to protect them from the weather. The pipes within were scraped and painted and all joints examined, and recalked where necessary. These three important lines of pipe, crossing the Charles river in the way they do, are one of the weakest parts of our system and are liable at any time to break. In such an event great inconvenience and danger from fire would result in that section of Charlestown situated on Charlestown Heights. Considerable difficulty would be involved in the repairs, and a great loss of water might result. A pipe tunnel will have to be built ere long from the Boston side to the Charlestown side of the river and the three lines of pipe placed therein. This is the only safe way to carry them across.

In the latter half of the year a system of gate inspection was started which, I think, will be productive of much good. A gang equipped for removing mud from the boxes precedes the inspection gang and makes the gates accessible. The inspection gang follows and tries the gate, oils it, packs it, when necessary, marks its distance from some convenient point, determines its function (whether main, service, fire, motor, elevator, or blow-off), records its exact location, and compares the data acquired with the plans of the system. A history card is then made out for each gate, containing information as to the size, location, function, etc., and provision is made for records of future inspections, repairs and changes. This will eventually give the department a complete card system of its gates, which will prove to be of great value. Furthermore, in a large department there is an almost continual manipulation of gates and it is not uncommon for the men sometimes to omit raising the gate they lowered. This, of course, is detrimental to the circulation. Again, division gates between the high and low service have been found open when they should have been shut, likewise, blow-off gates. These omissions are very serious and to prevent them the operations of the men should be followed up very closely and methods devised to make such negligence impossible. These matters will be attended to by the chief gate inspector, and I hope for good results therefrom.

The usual work of repairing and removing gate boxes, frames and covers has been carried on, and while it is well nigh impossible to escape repairing the frames and covers and altering the grade of the boxes, yet we hope through the substitution of concrete for wood to avoid the necessity of renewing decayed boxes, the expense of which is quite a factor in our maintenance account.

BREAK IN 24-INCH MAIN, SOUTH STREET, NEAR JAMAICA STREET, JUNE 24, 1908.

Eighty petitions for main pipe to be laid in streets not previously supplied were investigated and measured, and in fifty-seven cases were granted and laid.

The cut facing this page shows a break in the 24-inch high service pipe in South street at Jamaica street, West Roxbury, June 24, 1908. Considerable damage resulted and, as may be seen, the trouble was due to the manner in which a manhole was built under and around our pipe. This was an especially wrong thing to do, but as in many other cases it was done and the inevitable happened. It may be said that good inspection, backed up by forceful protest, would prevent such work, but it is sometimes almost impossible with a limited number of inspectors to thoroughly cover every job progressing in close proximity to our pipes. Unfortunately, corporations and some city departments are very often concerned only about the completion of their work, regardless of the manner in which it affects the pipes and fixtures of this department.

HYDRANTS.

During the year **274** public and **6** private hydrants were established, and **192** public and **2** private hydrants were abandoned, making a total number of **7,919** public and **308** private and suburban hydrants connected with the system January 31, 1909. This work comprised not only the establishment of additional new hydrants, but also the changing of the style and location of old hydrants.

Following is a statement of the cost of hydrant work during the year:

Establishing 86 additional hydrants of different styles		$10,434 48
Changing style and location of 194 old hydrants		16,868 59
Hydrants repaired on account of various defects	516	5,802 80
Hydrant barrels changed for various reasons	122	
Hydrant wastes renewed	20	
Hydrant boxes renewed	418	6,239 88
Hydrant boxes repaired	220	
Hydrant frames and covers renewed	95	
Hydrant inspections in cold weather	80,237	9,406 74
Hydrants oiled and tested	1,289	
Hydrants thawed out	140	
Hydrant boxes pumped and cleaned of mud and water	1,727	
Hydrant boxes hayed in cold weather	124	
Hydrants painted	5,316	1,694 11
Hydrants equipped with $4\frac{1}{2}$-inch nozzles	27	87 61

Hydrant caps changed from old style to new . .	299	
Hydrant caps fitted with washers, 2½-inch . .	1,548	$502 30
Hydrant caps fitted with washers, 4½-inch . .	1,796	

From the foregoing it may readily be seen that the hydrants are quite an expense to the department. In laying main pipe it is always necessary to provide for the maximum hydrant requirement. If that were unnecessary, mains of much smaller diameter would suffice. Hence, at least one-half of the expense of laying main pipe may properly be charged to hydrant service. Formerly the Fire Department paid the Water Department a certain sum yearly for each hydrant. It was supposed to cover the expense of the hydrant and its maintenance, and pay for the water used at fires. No payments have been made for the last ten years, however, and as a result, the Water Department, supported by a special tax, has been contributing in a large measure towards the maintenance of a department whose entire support should come from the general tax levy. This is clearly wrong.

There are five different styles of hydrants in use in the department, viz.: the Lowry, Boston Lowry, ordinary post, Boston post and Boston.

The Lowry is a hydrant the barrel of which is entirely underground and set directly upon the main. Connection is made with it by means of a chuck. The diameter of the barrel is 9 inches and the diameter of the valve is 6½ inches. It is a very efficient hydrant so far as delivering water is concerned, especially when it sets upon a four-way branch of large waterway. The objectionable feature about it is the delay occasioned by applying the chuck and the care necessary in the winter season to keep the cover free from snow and ice. During the past year the department purchased and delivered to the engine houses throughout the city 2,527 sacks of coarse salt, which was used by the firemen for that purpose. This style of hydrant is not being established in the outlying sections of the city, or in any place where the sidewalk is wide enough to accommodate a post hydrant. It is therefore confined largely to the business section of the city. At the present time 2,097 public and 31 private and suburban Lowrys are connected with the system.

The Boston Lowry is similar to the Lowry inasmuch as it sets entirely underground and requires a chuck as the medium of connection with a fire engine. The barrel, however, is only 5½ inches in diameter and the valve is 4 inches. It is usually set on the ends of mains and in sidewalks too

narrow for a post hydrant. At the present time 802 public and 6 private and suburban Boston Lowrys are connected with the system.

The ordinary post hydrant is the first type of post hydrant used by the department. It is set in the sidewalk and does not require a chuck for connection, it having one $4\frac{1}{2}$-inch steamer connection, and two $2\frac{1}{2}$-inch hose connections. It has but one valve, however, and this necessitates shutting off the supply when a second engine is to be connected. The barrel is 6 inches in diameter and the valve 5 inches. It is being replaced as rapidly as practicable by the improved type of post hydrant called the Boston post. At present there are 3,024 public and 138 private and suburban ordinary posts connected with the system.

The Boston post is the latest and most efficient type of post hydrant now in use by the department. It is a development and improvement of the Bachelder post. It has two $4\frac{1}{2}$-inch steamer connections and one $2\frac{1}{2}$-inch hose connection, all controlled by valves independent of the main valve which allows the water to enter the barrel from the main. The barrel is $7\frac{1}{4}$ inches in diameter, and the main valve 6 inches. The valves controlling the nozzles are of the "gate" or "slide" type and occupy a minimum amount of space, thus giving a correspondingly free waterway and facilitating the delivery of a large volume of water,—estimated to be about 2,500 gallons a minute under favorable conditions. The department feels that it has in this type of hydrant one that is as good if not better than any used in the large cities of the country. There are at the present time 1,745 public and 16 private and suburban Boston post hydrants connected with the system.

The Boston hydrant is an obsolete type, used years ago to a great extent, but now being abandoned wherever the opportunity presents itself. It is set entirely underground, usually in the sidewalk and allows of the connection of a $2\frac{1}{2}$-inch hose. At the present time it is not to be thought of as a fire-fighting fixture. Many of them are used as private means of supply to steamers along the wharves. There are now 251 public and 117 private and suburban Boston hydrants connected with the system.

All the hydrants are set in wells surrounded by wooden or concrete boxes, and are equipped with automatic wastes.

As reference to the section headed "Shop Work" will show, the department manufactures all the hydrants now used.

While upon the subject of hydrants I wish to call your attention to a very serious matter which before long will have

to be dealt with in a firm and decisive manner, viz., the abuse of hydrants by careless and ignorant operators. As you no doubt know, hydrants are primarily a fixture for the use of the Fire Department, and their value as such depends upon their readiness for use, which, in turn, is dependent upon their working order. Now it is an almost hopeless task to keep hydrants in a good mechanical condition while they are being operated by "anybody and everybody." Our hydrants, in common with the rest of our fixtures, open to the right or exactly opposite to the direction in which most mechanical devices unscrew. The ignorant operator in his vain endeavor to open to the left applies all kinds of force with the frequent result that before he realizes that he is turning the screw the wrong way it is strained, bent or broken, and the valve packing below is crushed into a useless mass. Again, when he cannot secure the wrench that is made for the hydrant, he uses a Stillson wrench or some crudely made device that will do the work after a fashion. The result of this is to wear off the corners of the pentagon shaped valve nut, and when the regular socket wrench used by the Fire Department is applied there is nothing to hold it and it revolves around the nut without having any effect upon the valve. It can easily be imagined what a serious state of affairs this might cause at the start of a fire. Helpless to stay its progress because of lack of water, the firemen would have to view the development of a conflagration, perhaps. Again, very few of these ignorant and careless men, who act without authority in many cases and without knowledge in every case, understand that there is a waste in the hydrant that will not operate unless a means is provided for the entrance of the air by leaving the nozzles open while the water is draining out of the barrel. Upon shutting off the main valve they immediately close the independent or nozzle valve and thus trap the water in the barrel; or, worse still, some do not close the main valve at all, but leave the pressure in the hydrant up to the nozzle valves. It is not difficult to realize how in cold weather a frozen hydrant will result from these conditions, and a frozen hydrant is not a trifling matter in the event of a fire.

I am of the opinion that hydrants should be operated exclusively by the Fire and Water Departments, and other departments and contractors should secure their water through other means. The police should be called into the matter to assist in the enforcement of the regulations.

Tables III. and IV. appended show the number of each style of hydrant established and abandoned during the year, the districts in which they are located, and the total numbers in the system January 31, 1909.

SERVICE PIPES.

Twelve hundred and twenty-seven service pipes, of diameters varying from ⅝-inch to 10-inch, were laid during the year, and 229 were abandoned. The net increase for the year was 998. The total number of services in the system is **95,045.** The term "service pipe" includes not only those pipes supplying water to premises for strictly domestic purposes but also fire, motor and elevator pipes. Tables V. and VI. appended give details as to number, size, length in feet, etc. All ⅝-inch service pipes are made of lead. Those ranging from ¾-inch to 2-inch, inclusive, are made of lead, and lead-lined iron. Pipes of 3 inches and upwards in diameter are cast iron.

The total cost of laying the different sized pipes was as follows:

1	10-inch with a total length of	24 feet . . .	$154 77
4	8-inch with a total length of	99 feet . . .	325 71
4	6-inch with a total length of	50 feet . . .	360 63
23	4-inch with a total length of	346 feet . . .	2,219 34
29	3-inch with a total length of	639 feet . . .	2,658 68
19	2-inch with a total length of	377 feet . . .	1,093 30
36	1½-inch with a total length of	642 feet . . .	1,398 60
19	1¼-inch with a total length of	513 feet . . .	700 26
62	1-inch with a total length of	1,406 feet . . .	1,693 12
36	¾-inch with a total length of	1,484 feet . . .	1,097 97
994	⅝-inch with a total length of	21,558 feet . . .	17,330 17
1,227		27,138	$29,032 55

The foregoing costs include not only the laying of pipes to new buildings but also the replacement of pipes of smaller sizes to old buildings. In the latter class there is the additional cost of plugging the abandoned pipes. Blasting and repaving were factors in many of the jobs and swelled the costs accordingly. In regard to repaving, this is annually becoming a more expensive item on account of the increasing use of expensive pavements like wooden block, asphalt, bitulithic and granite blocks with pitch and pebble joints. When, in conformance to the new meter law, meters will be attached to all new services, as well as to the old ones, the cost of laying a service pipe will be further increased. We have recently found it necessary in expensively paved streets to set over the corporation cocks, iron frames and covers that show in the surface of the street and allow of the operation of the cock without the necessity of disturbing the pavement. These covers are especially desirable on service pipes too small for gate valves and too large for sidewalk cocks.

The demand for larger service pipes is yearly increasing, due no doubt to the requirements of modern plumbing, the

erection of larger buildings, and the installation of the automatic sprinkler system of fire protection. The extension of the high service is a resultant of these new phases and, whereas a few years ago the high service system was somewhat limited in its scope, it will not be long before it is extended throughout the greater part of the city. Provision for a larger supply to meet this situation will soon have to be made. Fisher Hill Reservoir, the only distributing basin for the high service of the city (East Boston excepted), has a capacity of only 15,500,000 gallons, which would supply the city but a very short time in the event of a breakdown in the pumping machinery at Chestnut Hill, or serious defects occurring in the force mains between the pumps and Fisher Hill. A site for a storage reservoir of large capacity should be selected at once, preferably in the West Roxbury district upon a sufficiently high elevation.

In the consideration of applications for larger service pipes I would suggest that the size granted be as small as practicable and an effort made to compel builders and building owners to install plumbing of a sufficiently large size. There is a growing tendency on the part of the public to require the Water Department to compensate for the loss of head due to small sized pipes inside of buildings by the laying of large sized pipes outside. Although the large sized service pipes are paid for, yet they add to the expense of the department through increased cost of maintenance, the necessity of a larger meter, and the liability of greater water damage in the event of a leak.

The maintenance of service pipes is an item of considerable importance and expense. During the year 17,369 repair and maintenance jobs were performed at a total cost of $15,178.28; 754 investigations were made, where it was found that the department was not required to do any work, at a total cost of $1,907.27; and 1,127 inspections of street openings, and the repaving of them by outside parties, were made at a total cost of $866.51. Considerable portion of the "repair and maintenance" work referred to was of a trivial nature, such as, for instance, driving down a sidewalk upright to grade, which is usually accomplished by a few blows of a rammer. To afford you an idea of the chief causes of trouble in the service pipe system, I shall mention the following:

	Total Number During the Year.
Sidewalk uprights above or below grade	13,379
Pavements repaved or repaired where they were opened on account of service pipe	1,169
Service pipes shut off and let on to allow of repairs by owners	748

	Total Number During the Year.
Stoppage due to rust and dirt	543
Leaks due to settlement of earth	281
Leaks due to defective pipes	275
Sidewalk uprights repaired	222
Sidewalk uprights renewed	157
Sidewalk cocks renewed	83
Defective couplings	54
Operations of city departments, corporations and contractors	52
Struck by pick	50
Natural frost	46
Main uprights renewed	35
Defective joints	30
Electrolytic action	25

(and numerous others.)

Leaky service pipes are a most important factor in the excessive waste of water throughout the system. Many of them are pipes that formerly supplied buildings which do not now exist. They might have been shut off at the sidewalk cock, or, as in many cases, they might simply have been "hammered up." At any rate, some time afterward they started leaking and it is only by accident that the leak was discovered. We hope, however, with the aid of the Deacon Meter System to discover and stop all such cases. Another cause for waste, and also possible damage, is the leaking of services that were laid a few years ago under statute requirements to vacant lots. In one street during the past year eleven of such pipes were found leaking, several of which were running full head. The law requiring the laying of service pipes to vacant lots is not now in force but, unfortunately, there are hundreds of such pipes in the system. I shall endeavor during the coming year to shut off at the main all such pipes. It will be a somewhat extensive job, as in each case it will be necessary to dig down to the main upright, but I think it will pay in the end.

WATER POSTS.

During the year four water posts for street sprinkling carts were established and five abandoned, leaving a total number of 519 connected with the system January 31, 1909. The total cost of the work was $144.93, which was charged to the Street Watering Department. At the request of said department the following work was done:

Water posts shut off and let on during cold weather	161	Total Cost. $1,692 63
Water post repairs of miscellaneous kind, chiefly defective valves and cocks	374	

Formerly the Water Department assumed full charge of these posts, but in 1906 the Street Watering Department took the care of them, and since then we do nothing towards their maintenance, except upon orders from that department. Aside from the painting of the posts and their equipment with hose, the principal care is that of keeping them from freezing during the changeable weather of the early spring and late fall. At such times it is necessary to shut them off at night and turn them on the following morning. Early last spring the Street Watering Department was deceived by some balmy weather and allowed the posts to remain turned on one night, when a sudden drop in the temperature occurred and the result was that about every post in the city was more or less damaged by frost. This accounts in a great measure for the high total cost of repairs for the year.

Fountains.

During the year three new drinking fountains were established: one for beasts in King square, Dorchester; one for beasts at junction of Saratoga and Bennington streets, East Boston; and one for humans at the Orient Heights railroad station, East Boston. Two fountains were relocated and four fountains were abandoned. The total number now controlled by the department is 106. For the different styles and locations by districts, see Table VII. appended.

The total cost of the work of establishing the three new fountains was $696.43; and that of relocating two fountains was $247.12. The work of abandoning four fountains shows a credit balance inasmuch as the fixtures were recovered and are now in stock fit to be re-established should it be deemed expedient. Their value exceeds the cost of taking them out of service.

The playing fountain in service in the Frog pond, Boston Common, ever since 1848, when Cochituate water was first turned into the distribution pipes of Boston, and which was changed into an electrical fountain during the summer of 1907, was restored to its original form at a cost of $277.44. During its service as an electrical fountain it was connected with the 16-inch high service main, but as it was not considered desirable to have it off this valuable and somewhat limited service, the connection was removed and the fountain supplied from the low service. The nozzles that produced jets of varied form were repaired, and a concrete tunnel wherein the electrical fountain was operated was demolished. Stepping stones of concrete were set in the pond to allow of a foot pas-

sage from the shore to the fountain, and the fountain itself was moved out nearer to the center of the pond. A hydrant that served to supply the Frog pond, and indirectly the pond in the Public Garden, and which was established to replace the original fountain in its function as a supply while the electrical fountain was in existence, was abandoned and its connections removed.

In the work of maintaining the fountains 110 repair jobs were performed, and the drinking troughs for horses were inspected and cleaned 2,318 times at a total cost of $3,090.56. During the summer season 1,168 tons of ice, costing $3,504, were purchased of and delivered by the Boston and Hygeia Ice Companies to the cold water fountains, and an inspection of the same made by the department.

From the manner in which the cold water fountains are treated by certain members of the community, their maintenance appears to be a thankless task. The self-closing cocks are stolen and most maliciously damaged. The dippers and chains are also stolen and in some cases the basin part of the fountains is made the receptacle for all kinds of unmentionable filth. The ice is stolen from the boxes and it seems to be a hopeless toil to keep the fountains in a condition to be of service to worthy people. Children gather around these fountains and play with the water in such a manner as to make it a matter of risking one's clothes and dignity to approach sufficiently near to drink.

In a similar manner the old style of drinking troughs for horses are abused. The water in them is so polluted by the introduction of foreign matter that it is really inhuman to allow an animal to drink of it. Not only are sticks, stones, tin cans, etc., thrown in, but overalls and other articles of clothing are washed therein, and it is not uncommon to see them used as footbaths. In a few cases young children have been entirely immersed in the water.

All this is most discouraging, and I recommend that as far as the horse troughs are concerned the old style of low stone trough be done away with wherever practicable and replaced by the high circular bowl that sets to advantage in the center of squares and intersecting streets. Children are not so much inclined to play about this kind of fountain; there is a constant flow that insures pure water; and they are of such a height that a horse can drink without being unchecked. This last feature is most important, as a great many drivers refuse to water their horses rather than get down off their seats to uncheck them.

Another matter that requires attention is the rearrange-

ment and relocation of the fountains in the city. In the past many of them were erected at the request of members of the City Council in locations that ignored the lines of traffic and the general distribution of the fountains with a view of serving the requirements of the city as a whole and in the most economical and efficient manner. The local phase only of the matter was considered, and it was extremely local at that. In establishing drinking fountains points of vantage should be selected that would intercept the flow of travel. In such manner a few fountains would do the work of many located indifferently.

Waste Detection.

The daily average per capita consumption having reached the very high figure of 158 gallons, an earnest effort was made to operate the Deacon System of Waste Detection, with the object of lessening that figure if possible. The daily average consumption in that part of the West Roxbury district supplied by the "extra high," or Mt. Bellevue tank, service having increased from 459,700 gallons in January, 1908, to 698,000 gallons in September of the same year, and the night rate, or waste, having increased within the same period of time from 213,000 gallons to 435,000 gallons daily, our attention was directed to that district. Tests were made that showed the waste to be almost entirely on the inside of premises, the only outside leak found and repaired by the department being in a $\frac{5}{8}$-inch service pipe at No. 87 Bellevue street, where the pipe was found badly split and wasting at the rate of 1,500 gallons hourly. Those streets in which it was found that waste was going on within the premises were inspected by the waste department of the Income Division, and after considerable work the daily average consumption was brought down in November to 446,000 gallons, and the night rate, or waste, reduced to 222,000 gallons. Cold weather having set in efforts to further reduce the waste had to be deferred until spring, when we hope to eliminate the remainder.

In the East Boston district the Deacon System was operated in November but, beyond an excessive rate of waste throughout the district, nothing more than a start was made to locate the exact points of leakage. In the short time in which we were engaged, we located a $\frac{1}{2}$-inch service pipe, in Belmont court, which had been shut off at the sidewalk cock years ago, instead of being plugged at the main. It was found broken at a point about two feet from the main and had been wasting continuously at the rate of about

700 gallons per hour. We also found and repaired a bad leak in a service pipe at No. 111 Everett street, amounting to 600 gallons per hour; and upon Staples wharf, near the North Ferry, an old pipe which ran the entire length of the wharf was found badly split and was wasting into the harbor at the rate of about 10,000 gallons hourly. This pipe was disconnected and abandoned by the owners of the wharf.

During the coming spring and summer the Deacon System will be operated in a manner which, I hope, will produce telling results and reduce the rate of waste to a more reasonable figure. This will be impossible, however, unless the indications of the meter are followed by a thorough and adequate inspection by the Income Division. This inspection to be of value must not only discover leaks within premises but also enforce the repairing of the same.

The number of Deacon meters in the different sections of Boston that are set and can be operated at will are:

City Proper	26
East Boston	7
South Boston	13
Charlestown	4
Roxbury	14
Dorchester	7
West Roxbury	4
Brighton	2
Total	77

In addition there are:

Meter at yard to be set in Harvard street, City Proper	1
Meters set at Long and Deer Islands to be cut out and reset in West Roxbury	2
New meters in yard	3
Meter pot destroyed at the time of New York, New Haven & Hartford Railroad work in Castle street, making the internal machine useless	1
Meter set at Pearl and Medford streets, Charlestown, but useless at this point owing to high service extensions	1
Total	8

Electrolysis.

This is a factor of growing importance in the distribution systems of all large cities. No practical means has yet been devised that will thoroughly insulate water pipes from the electric current that flows underground. Investigation, experimentation and data collected from various sources have given us considerable knowledge about the tendencies and effects of current flowing on and off water pipes, but, like many other questions regarding electricity, we are still quite in the dark. One thing is certain,—a considerable amount

of electricity is flowing on and off our pipes, and in all cases where the latter condition obtains injurious effect of varying extent results.

The subject is receiving the attention of the water departments of large cities and with the assistance of expert knowledge some definite means of overcoming the trouble will no doubt be acquired. In the meantime this department has one investigator constantly employed, and another irregularly, making tests and gathering valuable data. Testing stations are established at points where by reason of previous tests it is known that current is flowing in quantity and potential of dangerous proportions, and readings are taken regularly. We are thus informed as to changes in conditions and are enabled to govern ourselves accordingly.

We are now experimenting with a sheath device attached to service pipes, consisting of a section of iron pipe about 4 feet long and of larger diameter than the service pipe which it envelops. It is connected with the service pipe at both ends by means of copper wire and it is placed around that part of the service passing closely under or over an electrical or other conduit which might have a tendency to attract any current that the service pipe is carrying. Where the sheath is thus attached the presumption is that the current will leave the lead pipe by means of the copper connecting wires and flow into the iron pipe and thence to the conduit, thus making the point of departure occur in the iron pipe instead of the lead pipe. As electrolysis occurs at that point the service pipe is thereby saved and the iron pipe sustains the damage. The locations of service pipes thus equipped are recorded, and in due time examinations will be made and any changes in the condition of either the pipe or sheath will be noted.

Shop Work.

The Distribution Division has seven shops, viz., machine, blacksmith, carpenter, paint, plumbing, pattern and concrete box shops. These shops are so involved with each other, in a considerable amount of work performed, that they will have to be treated accordingly. Other work, peculiar to certain of the shops, will be accounted for separately.

The power necessary to operate the machinery in the machine, blacksmith, carpenter and pattern shops, and also the two elevators and the yard saw, is furnished by two horizontal tubular boilers and one Brown single cylinder engine. The maximum possible horse power of the plant is approximately eighty, but the actual horse power developed is

twenty-seven, which is all that is necessary. One engineman and a fireman are in attendance six days in the week except in cold weather, when an additional fireman is employed to attend the boilers during the night when steam is maintained for heating purposes.

A considerable saving in the amount of coal used has been effected during the past year over that of the year previous. This is due to a combination of conditions, viz., a lesser number of firemen employed, better firing, good quality of coal, and the burning of refuse material, sawdust, etc. During the year 1907–08 671,200 pounds of coal were burned, with a percentage of 13.5 ash and clinker. During 1908–09 497,000 pounds of coal were burned, with a percentage of 10 ash and clinker.

Some improvements have been made in the construction of gate valves manufactured by the machine shop. Those ranging from 3 inches to 16 inches, inclusive, in size, are now made with solid bodies, and a saving in labor, lead, bolts and cast iron results. The bolt holes in the flanges of gates up to 16 inches and also those in post hydrants are now cast, thus saving the labor of drilling them. The rings or valve seats are screwed into the small gates and expanded in those of 10 inches and larger. The nozzles of the post hydrants instead of being "leaded" into the outlets are now screwed into the solid metal, the inside face of which forms a seat for the independent valves.

In the following statement of manufactures and repairs in the machine shop the cost per article includes not only the direct labor cost plus the cost of material but also an additional 70 per cent on the direct labor cost, which is considered a proper addition for contingent expenses, such as administration costs, supervision, power, tools, tool repairs, holidays, maintenance of shop, supplies, etc. It corresponds to what a business house would add before deciding upon a selling price for its manufactured articles. The direct labor cost includes only the labor of the machinist who does the actual work of converting the rough casting into a finished part and assembling the parts into a complete article.

STATEMENT OF STOCK MANUFACTURED FROM THE ROUGH DURING THE YEAR IN THE MACHINE SHOP.

ARTICLE.	Number.	Cost Each.	Total Cost.
3-inch gate valves	9	$12 34	$111 06
3-inch gate valves for blow-off	7	13 29	93 03
4-inch gate valves	6	15 39	92 34
6-inch gate valves	47	21 98	1,033 06
8-inch gate valves	102	29 64	3,023 28
10-inch gate valves	17	49 09	834 53
12-inch gate valves	73	56 71	4,139 83
16-inch gate valves	8	102 24	817 92
24-inch gate valves	3	313 97	941 91
Boston post hydrants	169	48 42	8,182 98
Bachelder post hydrants, I valve	37	51 17	1,893 29
Bachelder post hydrants, C valve	11	53 15	584 65
Lowry hydrants, 3 feet 3 inches	9	27 22	244 98
Lowry hydrants, 3 feet 6 inches	11	27 72	304 92
Lowry hydrants, 3 feet 9 inches	9	28 07	252 63
Lowry hydrants, 4 feet	11	28.57	314 27
Lowry hydrants, 4 feet 3 inches	7	28.83	201 81
Lowry hydrants, 4 feet 6 inches	5	29 36	146 80
Lowry hydrants, 4 feet 9 inches	9	29 89	269 01
Lowry hydrants, 5 feet 3 inches	2	30 39	60 78
Lowry hydrants, 5 feet 9 inches	3	31 78	95 34
1½-inch air cock	8	5 03	40 24
2-inch air cock	12	7 11	85 32
⅝-inch sidewalk cocks	1,296	72	933 12
⅝-inch sidewalk cocks, special	10	77	7 70
1-inch sidewalk cocks	42	1 51	63 42
½-inch corporation cocks	27	70	18 90
⅝-inch corporation cocks	1,391	76	1,057 16
⅝-inch corporation cocks, special	10	79	7 90
⅝-inch corporation angle cocks	157	76	119 32
¾-inch corporation cocks	99	1 28	126 72
1-inch corporation cocks	226	1 55	350 30
1½-inch corporation cocks	76	2 99	227 24
1½-inch corporation cocks, special	1	3 82	3 82
1½-inch water post cocks	17	2 66	45 22
Carried forward	.....	.....	$26,724 80

STATEMENT OF STOCK MANUFACTURED FROM THE ROUGH DURING THE YEAR IN THE MACHINE SHOP.—*Continued.*

ARTICLE.	Number.	Cost Each.	Total Cost.
Brought forward	.....	.....	$26,724 80
2-inch hose couplings	50	$0 55	27 50
¾-inch combination couplings	141	33	46 53
1-inch combination couplings	136	48	65 28
1½-inch combination couplings	50	96	48 00
2-inch combination couplings	100	1 16	116 00
1-inch combination bent couplings	6	79	4 74
2-inch combination bent couplings	27	1 44	38 88
3-inch female hose couplings	9	1 09	9 81
⅝-inch coupling nuts	554	057	31 58
¾-inch coupling nuts	700	095	66 50
1-inch coupling nuts	664	17	112 88
1½-inch coupling nuts	50	30	15 00
2-inch coupling nuts	125	42	52 50
⅝-inch coupling tubes	62	055	3 41
¾-inch coupling tubes	186	105	19 53
1-inch coupling tubes	100	14	14 00
1½-inch coupling tubes	50	275	13 75
1-inch bent tubes	6	42	2 52
½-inch male coupling	90	125	11 25
⅝-inch male coupling	483	11	53 13
¾-inch male coupling	184	205	37 72
1-inch male coupling	155	235	36 43
⅝-inch meter nipples	297	16	47 52
¾-inch meter nipples	100	24	24 00
1½-inch meter nipples	99	34	33 66
1½-inch meter nipples, special	12	46	5 52
2-inch meter nipples	40	55	22 00
¾-inch solder nipples	115	12	13 80
2-inch solder nipples	150	50	75 00
Nipples for Doherty cocks	41	15	6 15
Nuts for Doherty cocks	33	135	4 46
1-inch by ¾-inch meter bushings	12	18	2 16
1-inch meter bushings	100	27	27 00
¾-inch by ⅝-inch meter reducers	60	16	9 60
2½-inch by 2-inch reducers	6	1 31	7 86
Carried forward	.....	.....	$27,830 47

STATEMENT OF STOCK MANUFACTURED FROM THE ROUGH DURING THE YEAR IN THE MACHINE SHOP.— *Concluded.*

ARTICLE.	Number.	Cost Each.	Total Cost.
Brought forward	.....	.....	$27,830 47
⅝-inch iron plugs	401	$0 13	52 13
⅞-inch set screws	4,420	13	574 60
1-inch set screws	187	49	91 63
Post hydrant bolts	937	29	271 73
Lowry hydrant bolts	197	29	58 13
Boston Lowry hydrant bolts	127	45	57 15
Post hydrant extension bolts	53	59	31 27
Lowry hydrant extension bolts	31	54	16 74
Air cock bolts	44	57	25 08
Puddling head bolts	26	75	19 50
⅞-inch eye bolts	12	53	6 36
Fountain bolts	40	32	12 80
Fountain rings	540	02	10 80
Sidewalk uprights	1,168	54	630 72
Gate pins	2,496	015	37 44
Acorn nuts	18	08	1 44
3/16-inch screws	164	034	5 58
Hydrant wastes	348	52	180 96
Hydrant pump couplings	13	42	5 46
4-inch jointers	5	91	4 55
6-inch jointers	8	1 06	8 48
8-inch jointers	8	1 17	9 36
10-inch jointers	2	1 34	2 68
12-inch jointers	2	1 67	3 34
16-inch jointers	1	2 02	2 02
20-inch jointers	1	2 37	2 37
Total	.....	.....	$29,952 79

STATEMENT OF STOCK REPAIRED AND RENOVATED DURING THE YEAR IN THE MACHINE SHOP.

ARTICLE.	Number.	Cost Each.	Total Cost.
3-inch gates	2	$1 81	$3 62
4-inch gates	3	2 66	7 98
6-inch gates	18	2 66	47 88
8-inch gates	2	4 26	8 52
10-inch gates	2	9 74	19 48
12-inch gates	5	4 92	24 60
Boston post hydrants	1	7 37	7 37
Bachelder post hydrants	19	6 52	123 88
Post hydrants	45	5 60	252 00
Lowry hydrants	45	2 78	125 10
Boston Lowry hydrants	42	2 14	89 88
⅝-inch sidewalk cocks	64	17	10 88
¾-inch sidewalk cocks	2	17	34
½-inch corporation cocks	11	12	1 32
⅝-inch corporation cocks	246	10	24 60
¾-inch corporation cocks	10	12	1 20
1-inch corporation cocks	13	10	1 30
1¼-inch corporation cocks	3	12	36
1½-inch corporation cocks	4	15	60
⅝-inch angle cocks	24	14	3 36
2-inch hose couplings	19	14	2 66
1½-inch puddling head cocks	14	19	2 66
⅝-inch coupling nuts	1,262	007	8 83
¾-inch coupling nuts	26	007	18
1-inch coupling nuts	77	0085	65
1½-inch coupling nuts	26	0085	22
2-inch coupling nuts	9	0085	08
½-inch coupling tubes	18	007	13
⅝-inch coupling tubes	998	007	6 99
¾-inch coupling tubes	19	0085	16
1-inch coupling tubes	32	0085	27
1½-inch coupling tubes	20	017	34
2-inch coupling tubes	15	017	26
⅝-inch male couplings	34	0085	29
¾-inch male couplings	3	0085	03
Carried forward			$778 02

STATEMENT OF STOCK REPAIRED AND RENOVATED DURING THE YEAR IN THE MACHINE SHOP.— *Concluded.*

ARTICLE.	Number.	Cost Each.	Total Cost.
Brought forward	.....	.....	$778 02
1-inch male couplings	6	$0 017	10
1½-inch male couplings	3	017	05
2-inch male couplings	1	017	02
1½-inch solder nipples	8	07	56
2-inch solder nipples	8	07	56
Post hydrant bolts	12	05	60
Lowry hydrant bolts	18	03	54
Boston Lowry hydrant bolts	9	03	27
Post hydrant extension bolts	2	12	24
Lowry hydrant extension bolts	4	12	48
Hydrant wastes	130	07	9 10
1-inch set screws	5	085	43
10-inch jointers	1	48	48
12-inch jointers	2	48	96
Total	.....	.....	$792 41

STATEMENT OF STOCK MANUFACTURED DURING THE YEAR IN THE CARPENTER SHOP.

	Total Cost.
386 small wooden boxes for gate valves, at $3.80	$1,466 80
48 large wooden boxes for gate valves, at $4.72	226 56
338 wooden boxes for post hydrants, at $4.91	1,659 58
36 wooden boxes for Lowry hydrants, at $4.46	160 56
60 wooden boxes for Boston Lowry hydrants, at $6.07	364 20
24 wooden boxes for Boston hydrants, at $4.18	100 32
12 wooden boxes for Deacon meters, at $4.72	56 64
162 tops for small wooden gate-valve boxes, at 50 cents.	81 00
12 tops for large wooden gate-valve boxes, at 56 cents	6 72
74 tops for post hydrant boxes, at 61 cents	45 14
48 tops for Lowry hydrant boxes, at 61 cents	29 28
18 tops for Boston hydrant boxes, at 56 cents	10 08
2,584 inches in pieces for raising gate-valve boxes, at 9 cents	232 56
2,671 inches in pieces for raising hydrant boxes, at 10 cents	267 10
81 wooden horses, at 62 cents	50 22
39 6-inch diameter wooden plugs	20 64
200 2-inch diameter wooden plugs	13 25
640 wooden wedges for concrete boxes	3 61
4 post hydrant frames	5 60
20 wooden stoppers for oil cans	1 62
2,110 wooden wedges for main pipe work	35 67
100 wooden chocks for main pipe work	2 83
1,211 wooden paving blocks	27 38
Total	$4,867 36

NOTE.— In the above costs 20 per cent is added to labor cost to cover contingent expense.

STATEMENT OF STOCK MANUFACTURED DURING THE YEAR IN CONCRETE BOX PLANT.

	Total Cost.
319 small concrete gate-valve boxes (1¾ inches), at $6.85	$2,183 80
424 concrete post hydrant boxes (1¾ inches), at $7.06	183 52
72 concrete meter boxes (1¼ inches), at $6.64	478 02
9 concrete blocks for stepping stones in Frog pond, at $1.37	12 33
Total	$2,857 67

STATEMENT OF GENERAL WORK PERFORMED BY ALL THE SHOPS DURING THE YEAR.

	Total Cost.
Repairs in and around the stables	$2,106 21
Tool repairs of all kinds	2,006 66
Repairs and renovation of Albany street yard, including erection of concrete box shed	1,644 12
New tools made, 689	1,539 02
Repairs in and around the shops	1,393 25
Sharpened 13,068 picks, 2,184 bars and 4,284 chisels	1,139 20
Repairs and renovation of Dorchester yard	970 03
Patterns made, 71	903 90
Repairs and miscellaneous work at reservoirs	732 23
Repairs and renovation of Charlestown yard	656 66
Wagons and carriages repaired and painted	601 91
Odd jobs for Engineering Department	575 86
Work done for Water Commissioner's office	341 56
Patterns repaired and renovated	222 08
Accommodation work for outsiders	96 99
Repairs at East Boston yard	85 72
Work done at Mt. Bellevue tank, West Roxbury	72 06
Pipes, caps, curves and branches drilled in yard	56 75
Made 13 sealing covers for division gate valves	38 76
Work done at Orient Heights tank, East Boston	36 14
Repairs at West Roxbury yard	24 18
Made 3 pairs 10-inch iron straps	11 35
Made 72 iron dowels for meter department	9 53
Made 11 iron brackets for gate chambers	9 50
Made 348 iron nipples for concrete boxes, 1 inch by 1¼ inches	5 78
Made 2 clamps and 10 dog nails	3 56
Made 16 wharf bolts	3 35
Repairs at Brighton yard	2 93
Made 100 S hooks for hydrant chains	2 03
Made 4 corner irons for meter department	1 98
Made 12 iron wedges for engine room	80
Total	$15,294 10

CONCRETE BOXES.

Previous to the past year the manufacture of concrete boxes by this department was somewhat of an experiment, but we now have passed that stage and are making boxes out of concrete which are satisfactory in every respect and which will last almost indefinitely. The life of a wooden box varied with the soil in which it was set, and with conditions fairly good seven years was a rather long period. It may readily

be seen that a concrete box with an almost never ending life is a much more economical fixture than a wooden box even though the cost of the former may be slightly more than that of the latter. During the past year boxes for post hydrants, Lowry hydrants, small gate valves and meters were made out of concrete. They are composed of four reinforced concrete slabs with vertical edges beveled or mitered, so that when set up and in union with each other they form a box that is self-supporting. To keep the four sides of the box together while backfilling is in progress, the slabs are tied one to the other, at the corners, with short pieces of wire that are fastened to the reinforcement within.

The post hydrant and meter boxes being set in the sidewalk are only $1\frac{1}{4}$ inches thick, while the gate valve and Lowry hydrants boxes are $1\frac{3}{4}$ inches thick, because of the greater load imposed upon them in the roadway.

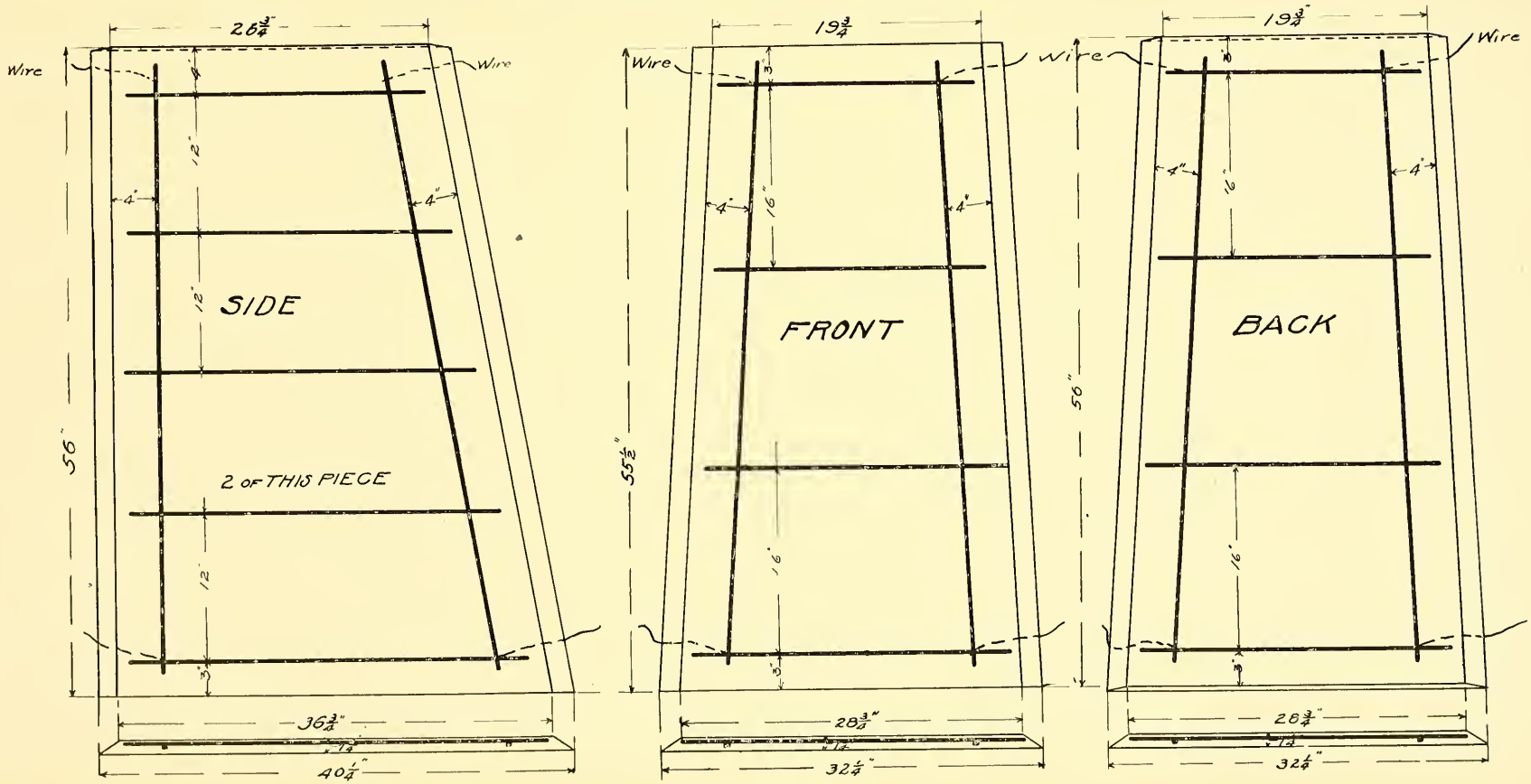
The proportion of the concrete is approximately 1–2–4. This is modified, however, in the construction of the $1\frac{1}{4}$-inch or thin slabs where the cement factor is increased somewhat. The reinforcement consists of $\frac{1}{4}$-inch twisted steel rods which are purchased cut in the desired lengths. They weigh about two-tenths of a pound to the linear foot. The sand is "Plum Island," bought by the cargo and delivered upon our wharf. It is clean and sharp and very satisfactory. The stone is finely broken "Roxbury pudding stone," small enough to pass through a screen of $\frac{1}{2}$-inch mesh and too large to pass through one of $\frac{1}{8}$-inch mesh. To thoroughly cleanse it from soil and other foreign matter, it is washed by a $2\frac{1}{2}$-inch hose stream over a screen of sufficiently large mesh to allow the water to carry off the undesirable material and retain the clean stone. We find that the washed stone increases the strength of the concrete. After being mixed in a "cube" mixer the fresh concrete is placed in wooden forms, the inside surfaces of which have been oiled, the reinforcing rods placed in their proper position, and the mass "worked" and compacted by the boxmaker by means of mason's and plasterer's trowels until it is well solidified and without voids. The forms are then placed in a rack to set and in about four days' time the slabs are taken out of the forms, marked, and placed in the storage shed to age and eventually to serve their purpose in the ground.

The drawings represented in the cut on the opposite page give an idea as to the dimensions and arrangement of the reinforcement. Although a plan of a post hydrant box, it is typical of the other boxes with certain modifications as to number of reinforcing rods and dimensions of slabs.

CONCRETE POST HYDRANT BOX

Reinforced with ¼ inch twisted Steel Rods.

1½ Inches = 12 Inches June 1908



Some data as to the boxes and their construction follow:

Post Hydrant.

Thickness of slabs, $1\frac{1}{4}$ inches.
Total area of slabs, 48.9 square feet.
Material used:
Portland cement, 127 pounds.
Plum Island sand, 200 pounds.
$\frac{1}{4}$-inch crushed stone (washed), 400 pounds.
$\frac{1}{4}$-inch twisted steel rods (.2 pound per foot), 77.6 linear feet.
No. 13 galvanized wire, .7 pound.

Lowry Hydrant.

Thickness of slabs, $1\frac{3}{4}$ inches.
Total area of slabs, 46.1 square feet.
Material used:
Portland cement, 155 pounds.
Plum Island sand, 250 pounds.
$\frac{1}{4}$-inch crushed stone (washed), 500 pounds.
$\frac{1}{4}$-inch twisted steel rods (.2 pound per foot), 80.5 linear feet.
No. 13 galvanized wire, .7 pound.

Small Gate Valve.

Thickness of slabs, $1\frac{3}{4}$ inches.
Total area of slabs, 35.7 square feet.
Material used:
Portland cement, 125 pounds.
Plum Island sand, 250 pounds.
$\frac{1}{4}$-inch crushed stone (washed), 500 pounds.
$\frac{1}{4}$-inch twisted steel rods (.2 pound per foot), 67.8 linear feet.
No. 13 galvanized wire, .7 pound.

Meter.

Thickness of slabs, $1\frac{1}{4}$ inches.
Total area of slabs, 43.8 square feet.
Material used:
Portland cement, 125 pounds.
Plum Island sand, 200 pounds.
$\frac{1}{4}$-inch crushed stone (washed), 400 pounds.
$\frac{1}{4}$-inch twisted steel rods (.2 pound per foot), 74.5 linear feet.
No. 13 galvanized wire, .7 pound.

Tests to determine the transverse strength of the $1\frac{1}{4}$-inch post hydrant slab and the $1\frac{3}{4}$-inch Lowry hydrant slab were made as follows:

Post Hydrant Slab. $1\frac{1}{4}$ Inches Thick.

The slab was supported with a span of $19\frac{3}{4}$ inches at the top and 28 inches at the bottom and was loaded with pig lead on the center line of span. The concrete was sixty days old. The cement used was Atlas. Destruction occurred at 2,600 pounds. The load per linear inch required to destroy the slab was 46.43 pounds.

Lowry Hydrant Slab. 1¾ Inches Thick.

The slab was supported with a span of 18½ inches at the top and 28½ inches at the bottom, and was loaded with pig lead on the center line of span. The concrete was sixty days old. The cement used was Atlas. Partial destruction occurred at 4,007 pounds. It was impracticable to add sufficient weight to cause total destruction. The load per linear inch sustained was 85.26 pounds.

As actual conditions will not test the boxes so severely the results as recorded above assured us of an ample margin of safety.

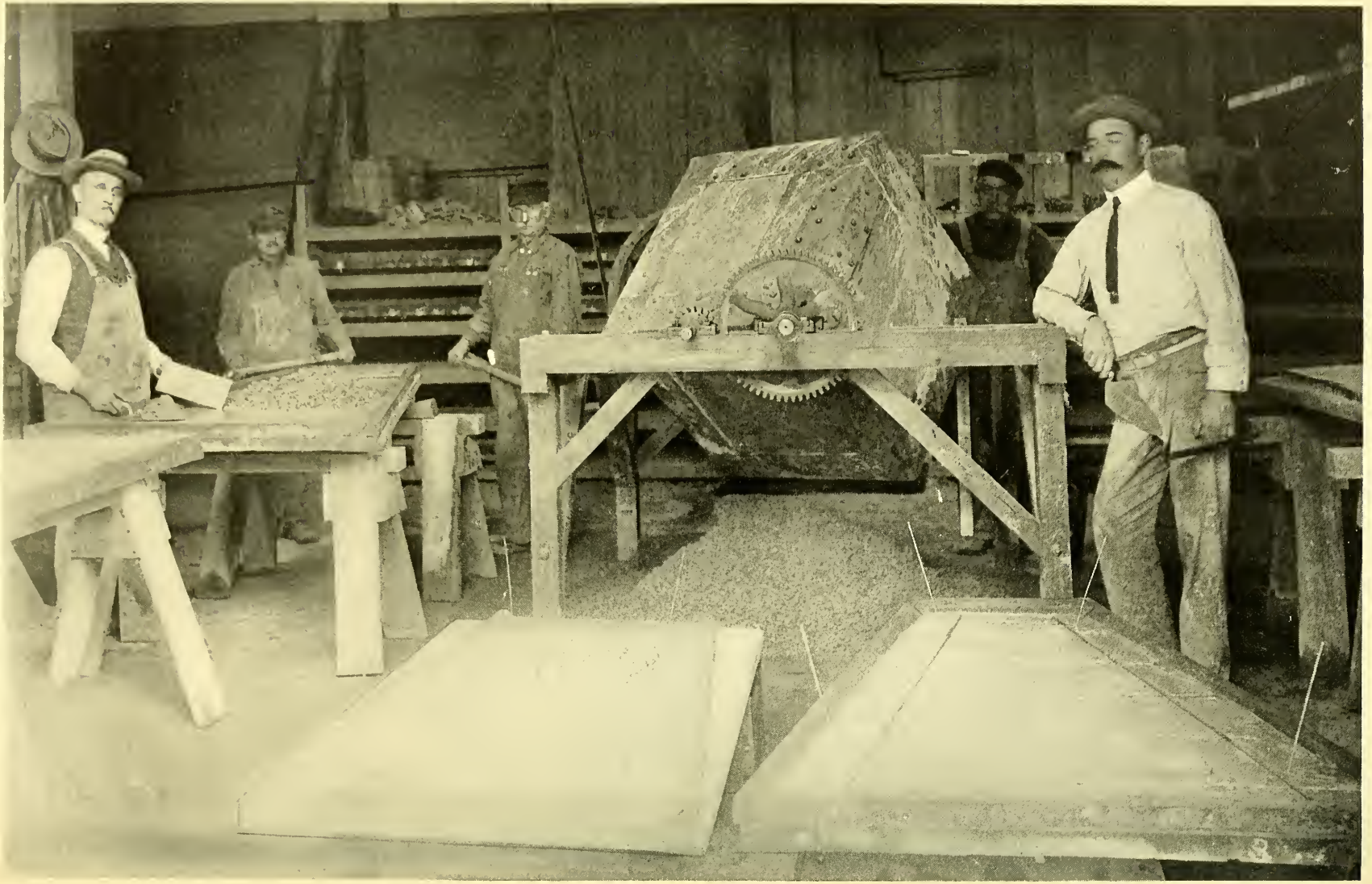
Cut facing page 70 shows the boxes set up just as they are in the ground, with iron frames and covers placed upon their tops. Each box is numbered and the date of making and the initial or private mark of the workman who made the slab is marked upon the same. The opening in the bottom of the meter box (the small box) is made to allow of the entrance and exit of the service pipe.

Cut facing page 71 shows a section of the interior of the shop and the concrete slabs in different stages of construction. Immediately under the cube mixer is a pile of freshly mixed concrete. To the left a workman is seen with trowels in hands about to spread the concrete evenly in the form. Upon the floor in front of the mixer are two slabs in the forms, both partly made, showing the reinforcing rods and the binding wires. In the rear are some of the racks in which the forms are kept while the concrete is setting.

PROPERTY AND PLANT.

Albany Street Yard.— Although cramped for space, as has been the case ever since the Sewer Division and the City Hospital took from us large slices of our property, yet by rearrangement, more compactness of our stock and the addition of conveniences for handling and storing the same we have been able to get along fairly well. A thorough and complete renovation of the old buildings took place during the year. The lead, wagon and derrick shed was reroofed and painted; the old wooden stable had new sills and concrete piers put under it, hot water and electric lights installed and clothes closets built for the men. The old windows and frames were replaced by new ones, and the outside of the building clapboarded and painted. A large shed for aging and storing concrete boxes was built. The concrete shop was enlarged.

CONCRETE BOXES SET UP AS THEY ARE IN THE GROUND.



INTERIOR VIEW OF CONCRETE BOX SHOP.

A thorough repairing of the paint shop was begun and is now in progress, a portion of the main floor being partitioned off for a varnish room, something that we lacked heretofore. A two-inch plank flooring was placed in several parts of the yard upon which to pile castings. Electric lights in clusters of three 32 candle-power lamps were installed at different points in the yard. This was a much needed improvement over the old and very unsatisfactory hand lantern, with which the men had to locate and load stock after dark. They also serve to expose to the watchmen people who have no business in the yard. The lower offices and hallways were equipped with electric lights and a few portable lights were installed in the machine shop, displacing the antiquated candle and enabling the machinist to see clearly his work in places that were hitherto obscure. The brickwork in the stables was repointed and a dangerous stone coping reset. The roof of the machine shop was repaired. The driveway was repaved with bitulithic pavement, thus stopping the noise that for years past had jarred upon the nerves of the administrative force and interfered with the transaction of business. The superintendent's office has been painted and the telephone system rearranged. The office furniture was varnished and the fixtures in general freshened. Seven old and disabled horses were humanely killed and replaced by new ones. Two old wagons and two old buggies were sold by auction and one wagon broken up and burned. These were replaced by the purchase of one new buggy, one second-hand buggy and one new wagon. All wagons and carriages requiring attention were repaired and painted, and a beginning was made in equipping the wagons with an extra half spring bearing upon the rear axle, which shares in the support of the load when it exceeds an amount sufficient to compress the regular springs beyond the safe point. This will lessen the repairs upon the springs in particular and the wagon in general. The harnesses, all of which were in a very poor condition, were examined and some were repaired, and others which were dangerously worn and beyond repair were replaced by new sets. The hay and grain are now purchased through competition and certificates guaranteeing the quality furnished with each lot. No. 1 hay and No. 2 oats are bought, it being considered ultimate economy to buy a high grade of hay, as the lower grades contain dust and vegetable matter of no nutritious value, but which figure in the weight of the hay. A clean, sweet, succulent hay will go farther and is cheaper in the end than an inferior grade. No. 2 oats are relatively much better than

No. 2 hay. The tool houses have all been repaired, painted and lettered. Bolts have been substituted for screws in the hinges, hasps and staples and they have been otherwise strengthened against thievery.

In general the property has been much improved and is now in a more valuable condition than for some years past.

Dorchester Yard.— The buildings in this yard were repaired and painted, the roof of the stable was shingled, a new water-closet with modern plumbing installed, a new hot water heater and a large railway stove were bought and set up in the stable and office. The fence surrounding the yard was rebuilt and painted. Electric lights were installed, replacing lanterns. The yard is now in first-class condition and presents a very creditable appearance.

Charlestown Yard.— New gutters and conductors were placed upon the buildings. New sills were put under the large wooden building occupied by the Income Division in part with this division. The outside walls of this building were reclapboarded. The stalls in the stable were repaired. A new steam heating system was installed in the office aud repair shop. Modern plumbing replaced old-fashioned and defective fixtures, and the yard and buildings in general were much improved and are now in first-class condition with the exception of painting, which will be done in the coming spring.

East Boston Yard and Reservoir.— Aside from the repairing of the iron fence around the reservoir grounds nothing of importance was done here during the year. It is intended to move in the early spring from the present quarters to the old pumping station in Condor street, opposite Brooks street, which will allow more yard room and prove in every way a more desirable place.

West Roxbury Yard.— This yard is not owned by the department. Therefore only repairs that were absolutely necessary to facilitate the work of the district were made. The location is not as central as it might be, especially now that the district is growing in the southern part. There are no sheds in the yard to cover and protect stock and appurtenances. The stall room is limited and altogether conditions are such as to require a change in the near future.

Brighton.— This can hardly be dignified by the word "yard." Conditions here are such as to demand a change to more commodious and suitable quarters as soon as possible. I would suggest that an effort be made towards securing a portion of the Street Department's yard on Chestnut Hill avenue.

Fisher Hill Reservoir.— Aside from the fact that this basin is rather small for the demands now made upon it, the property in general is in good condition and is well kept by those in charge of it.

Brookline Reservoir.— Although this reservoir has been sold to the town of Brookline, by the terms of the agreement we yet have charge of the property. It is not in use as a part of our system and we simply hold it until such time as we feel absolutely sure that we will not be required to use it. This we hope will be upon the completion of the new line of 48-inch pipe to be constructed by the Metropolitan Water Board in Beacon street, between Chestnut Hill reservoir and Coolidge's corner.

Parker Hill Reservoir.— This reservoir and grounds should be transferred to the Park Department and thus relieve the Water Department of further care and maintenance. It is of no value as a reservoir at the present time.

Mt. Bellevue Standpipe, West Roxbury.— Some repairs to the cover of the tank, the stairway and floor of the observatory were made during the past year. Otherwise the property is in good condition.

West Roxbury Pumping Station.— Although this station is owned by the Boston Water Department it is occupied and maintained by the Metropolitan Water Board.

Orient Heights Standpipe, East Boston.— Aside from the maintenance of the apparatus connected with the recording gauge between the standpipe and the yard office in Brooks street, there was nothing of importance done here. The long stretch of telegraph wire between the above-mentioned points has to be inspected every few weeks and quite frequently repairs are necessary, especially in the winter. The freezing of the water in the tank interferes with the operation of the float connected with the gauge, and constant attention is required to prevent such an occurrence.

Recording Pressure Gauges.— The following recording pressure gauges are the property of the department. They were installed and are maintained by this division and the readings recorded by the Engineering Department. They are all in working order.

LOCATION.	Service.	Grade of Gauge Above City Base.
Chestnut Hill pumping station	Low	127.5
Boston Common	Low	43.2
Salem street, near Prince street, Engine 8	Low	27.2
East street, at East street, Engine 7	Low	22.7
Congress street, South Boston, Engine 38	Low	21.1
Fourth street, at O street, South Boston, Engine 2	Low	51.8
710 Albany street, Boston Water Department	Low	24.0
Gibson street, Dorchester, Boston Water Department	Low	29.3
Western avenue, Brighton, Engine 34	Low	27.5
Bunker Hill street, Charlestown, Engine 32	Spot Pond	36.0
Marion street, East Boston, Engine 5	Spot Pond	64.3
City Hall, Boston	High	105.1
Quincy street, Roxbury, Engine 24	High	98.3
Walnut street, Neponset, Engine 20	High	20.8
Norfolk street, Mattapan, Engine 19	High	79.1
Chestnut Hill avenue, Brighton, Engine 29	High	111.5
Centre street, Jamaica Plain, Engine 28	High	82.9

GENERAL RECOMMENDATIONS.

1. That the missing sections of mains between Atlantic avenue and the pipe tunnel at Congress Street Bridge be laid, thus introducing much needed additional high and low service supplies to South Boston.

2. That a pipe tunnel be constructed to carry the high and low service mains under Charles river at Warren Bridge.

3. That steps be taken to provide East Boston with another source of supply independent of the two present lines crossing Chelsea creek.

4. That provisions be made for a high service storage basin of larger capacity than the present one on Fisher Hill, Brookline.

5. That pipes crossing under railroad tracks be either removed or so protected with sheaths or envelopes as to protect them from vibration.

6. That the heavy car problem be studied and some efforts made to solve it.

7. That more stringent regulations concerning the use of hydrants be made and enforced.

8. That the Deacon meter system of waste detection be operated upon a larger and more efficient scale than during the past year.

9. That new quarters be secured for the department force in Brighton and West Roxbury.

10. That an automobile emergency car be purchased and put into service.

Respectfully submitted,

GEORGE H. FINNERAN,
Official in Charge.

TABLE I.

Showing Length of Main Lines of Water Pipes and Connections Owned and Operated by Boston Water Department, and Number of Valves Set in Same, January 31, 1909.

	Diameter of Pipes in Inches.																Totals.
	48	42	40	36	30	28	24	20	16	12	10	8	6	4	3	2	
Length owned and operated January 31, 1908 (feet)	38,263	16,813	23,104	43,473	90,096	244	77,563	94,674	205,073	1,209,779	163,241	615,048	1,288,104 *	67,702	6,027	5,524 *	3,944,728 *
Gate valves in same	12	6	11	19	56	.....	63	71	394	2,515	518	1,713	3,973	515	10	7	*9,883
Air valves in same	24	5	10	24	59	2	35	36	22	26	3	.....	3	.....	.....	.....	249
Blow-offs in same	8	3	6	11	27	.....	17	41	55	134	20	24	27	2	.....	.....	375
Length laid or relaid during year 1908–09 (ft.)	912	.....	.....	145	283	.....	.....	1,246	4,032	21,888	8,497	13,478	3,318	3,728	.....	.....	57,527
Gate valves in same	.....	.....	.....	.....	.....	.....	.....	3	18	67	38	62	18	3	.....	.....	209
Air valves in same	1	.....	.....	1	1	.....	.....	5	1	3	.....	.....	.....	.....	.....	.....	12
Blow-offs in same	.....	.....	.....	.....	1	.....	.....	2	2	2	1	.....	.....	.....	.....	.....	8
Length abandoned during year 1908–09 (ft.)	.....	.....	.....	125	265	.....	110	196	192	7,253	71	3,060	12,040	1,983	201	.....	25,496
Gate valves in same	.....	.....	.....	.....	.....	.....	.....	.....	2	15	1	13	50	10	.....	.....	91
Air valves in same	1	.....	.....	1	1	.....	1	1	.....	1	.....	.....	.....	.....	.....	.....	6
Blow-offs in same	.....	.....	.....	.....	1	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....	3
Length owned and operated January 31, 1909 (feet)	39,175	16,813	73,104	43,493	90,114	244	77,453	95,724	208,913	1,224,414	171,667	625,466	1,279,382	69,447	5,826	5,524	3,976,759 †
Gate valves in same	12	6	11	19	56	.....	63	74	410	2,567	555	1,762	3,941	508	10	7	10,001
Air valves in same	24	5	10	24	59	2	34	40	23	28	3	.....	3	.....	.....	.....	255
Blow-offs in same	8	3	6	11	27	.....	17	42	57	135	21	24	27	2	.....	.....	380

* These totals differ from those in last year's annual report because of additions and corrections due to omissions and errors in the tables of previous years.

† 753.17 miles.

TABLE II.

Statement of Hydrant, Blow-off and Reservoir Pipes, January 31, 1909.

	Diameter in Inches.								Totals.
	16	12	10	9	8	6	4	3	
Total length connected with system January 31, 1908	474	6,530	126	2,423	2,492	42,670	6,384	44	61,143
Length laid and relaid during the year	.....	101	24	.....	526	1,262	86	.....	1,999
Length abandoned during the year	.....	55	.....	130	42	394	71	.....	692
Total length connected with system January 31, 1909	474	6,576	150	2,293	2,976	43,538	6,399	44	62,450

TABLE III.

Hydrants Established and Abandoned during the Year.

	ESTABLISHED.						ABANDONED.					
	Lowry.	Boston Lowry.	Ordinary Post.	Boston Post.	Boston.	Totals.	Lowry.	Boston Lowry.	Ordinary Post.	Boston Post.	Boston.	Totals.
City Proper (public)....	6	1	....	21	....	28	16	1	4	1	7	29
" (private)...	....	....	....	1	....	1	....	....	...	....	1	1
Roxbury (public).....	1	3	....	37	1	42	17	3	6	3	2	31
West Roxbury (public).	....	8	4	52	....	64	5	17	11	3	2	38
Brighton (public).....	....	6	....	4	....	10	....	3	....	....	....	3
Dorchester (public).....	....	13	2	62	....	77	16	23	13	....	1	53
Dorchester (private)....	....	....	....	4	....	4	....	....	....	....	....	....
South Boston (public)..	....	4	....	17	2	23	7	2	1	1	9	20
East Boston (public)...	....	1	1	17	....	19	5	2	8	1	....	16
Charlestown (public)...	....	7	....	4	....	11	....	1	....	1	....	2
Deer Island (private)...	....	....	1	....	....	1	....	....	1	....	....	1
Total number of public..	7	43	7	214	3	274	66	52	43	10	21	192
Total number of private,	....	....	1	5	....	6	....	....	1	....	1	2

NOTE.— The columns headed "Boston Post" include what was known as the "Bachelder Post" (see text under "Hydrants").

TABLE IV.

Total Number of Hydrants in System January 31, 1909.

	Lowry.	Boston Lowry.	Ordinary Post.	Boston Post.	Boston.	Totals.
City Proper (public)	603	49	251	466	106	1,475
" (private)	4	.....	9	5	39	57
Roxbury (public)	469	91	429	302	37	1,328
" (private)	2	1	.....	3	10	16
West Roxbury (public)	101	226	651	177	26	1,181
" (private)	.....	.....	16	.....	1	17
Brighton (public)	74	92	391	35	18	610
" (private)	.....	.....	7	.....	2	9
Dorchester (public)	388	232	954	349	27	1,950
" (private)	.....	1	3	8	4	16
South Boston (public)	183	34	142	212	29	600
" (private)	3	.....	15	.....	28	46
East Boston (public)	110	33	173	110	6	432
" (private)	8	.....	7	.....	25	40
Charlestown (public)	169	45	33	94	2	343
" (private)	14	1	37	.....	6	58
Deer Island (private)	.....	.....	21	.....	.....	21
Long Island (private)	.....	.....	6	.....	.....	6
Thompson's Island (private)	.....	.....	2	.....	.....	2
Gallop's Island (private)	.....	.....	1	.....	1	2
Rainsford Island (private)	.....	.....	3	.....	1	4
Quincy	.....	1	11	.....	.....	12
Brookline	.....	2	.....	.....	.....	2
Total number of public hydrants	2,097	802	3,024	1,745	251	7,919
Total number of private and suburban hydrants	31	6	138	16	117	308

NOTE 1.— The column headed "Boston Post" includes what was known as the "Bachelder Post" (see text under "Hydrants").

NOTE 2.— Difference in figures from last year's report are due to corrections.

TABLE V.

Statement of Service Pipes Laid and Abandoned during the Year Ending January 31, 1909.

Sizes of Services Laid and Abandoned.	City Proper.		Roxbury.		West Roxbury.		Brighton.		Dorchester.		South Boston.		East Boston.		Charlestown.		Totals.	
	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.	Number of Services.	Length in Feet.
10-inch laid	1	24															1	24
8-inch laid	1	3							1	24	2	72					4	99
6-inch laid					1	12					2	27			1	11	4	50
6-inch abandoned											1	27			1	12	2	39
4-inch laid	16	184	2	55	1	14			1	6	2	72	1	15			23	346
4-inch abandoned	9	115	3	57	1	14											13	186
3-inch laid	17	325					1	42	2	27	3	118	2	48	4	79	29	639
3-inch abandoned	4	57							1	52			1	15			6	124
2-inch laid	8	154	1	2	2	41	1	55	1	2	2	24	1	2	3	97	19	377
2-inch abandoned	3	16	1	12	1	10			1	34	1	34			2	45	9	151
1½-inch laid	22	479	4	41	3	19	1	39	3	10	3	54					36	642
1½-inch abandoned	3	60															3	60
1¼-inch laid	10	302	1	2	1	47	3	39	2	34	1	49	1	40			19	513
1¼-inch abandoned	1	43							1	16							2	59
1-inch laid	31	651	10	294	3	52	1	22	7	89	6	146	2	54	2	98	62	1,406
1-inch abandoned	8	121	2	19	1	3	1	33			3	78	1	42			16	296
¾-inch laid	12	926	1	18			10	243	7	155	1	32	2	61	3	49	36	1,484
¾-inch abandoned	2	53			1	4							1	15	1	19	5	91
⅝-inch laid	52	956	79	1,720	152	2,774	67	1,523	413	8,885	119	2,568	83	2,312	29	820	994	21,558
⅝-inch abandoned	83	1,741	8	125	8	202	24	753	8	123	19	394	4	81	3	35	157	3,454
½-inch abandoned	1	22									3	86	5	120	7	124	16	352
Total laid	170	4,004	98	2,132	163	2,959	84	1,963	437	9,232	141	3,162	92	2,532	42	1,154	1,227	27,138
Total abandoned	114	2,228	14	213	12	233	25	786	11	225	27	619	12	273	14	235	229	4,812
Net increase	56	1,776	84	1,919	151	2,726	59	1,177	426	9,007	114	2,543	80	2,259	28	919	998	22,326

Note.—This table includes fire, motor and elevator pipes.

TABLE VI.

Total Number and Aggregate Length of Service Pipes of Various Sizes Connected with System January 31, 1909.

SIZES.	Total Number.	Aggregate Length.
16-inch	1	9
12-inch	14	3,542
10-inch	2	1,349
8-inch	26	2,751
6-inch	146	21,650
4-inch	1,102	45,181
3-inch	721	21,838
2-inch	1,839	59,244
1½-inch	1,279	39,207
1¼-inch	330	10,569
1-inch	2,319	129,802
¾-inch	2,510	92,936
⅝-inch	77,770	2,201,201
½-inch	6,986	160,100
Totals	95,045	2,789,379

TABLE VII.

Fountains.

Style. *Established during the Year.*

B. Cambridge street, opposite Rutherford avenue, Charlestown.
B. Junction of Saratoga and Bennington streets, East Boston.
B. Forest Hills square, West Roxbury.
B. King square, Dorchester.
C. Bennington street, at Orient Heights station, East Boston.

Abandoned during the Year.

A. Saratoga street, at Swift street, East Boston.
A. A street, at First street, South Boston.
B. 548 Main street, Charlestown.
B. Forest Hills square, West Roxbury.
C. North Bennet street, at playground, City Proper.
F. Hancock street, at Dorchester avenue, Dorchester.

Number of Fountains in Service January 31, 1909.

DISTRICTS.	Style A.	Style B.	Style C.	Style D.	Style E.	Style F.	Style G.	Totals.
City Proper	9	5	7	.....	12	.....	.....	33
Roxbury	8	2	1	.....	5	.....	.....	16
West Roxbury	5	1	.....	1	2	.....	.....	9
Brighton	5	.....	1	.....	.....	.....	.....	6
Dorchester	.....	3	2	1	.....	6	1	13
South Boston	1	1	4	.....	4	.....	.....	10
East Boston	.....	4	3	.....	4	.....	.....	11
Charlestown	1	3	.....	.....	4	.....	.....	8
Totals	29	19	18	2	31	6	1	106

Style. NOTE.

A. Indicates fountain for man and beast, with automatic fixtures for man and beast in warm weather and a continuous flow of water for beasts in cold weather.
B. Indicates fountain for beasts only. Continuous flow of water all the year.
C. Indicates fountain for man only. Automatic fixtures. In service during warm weather only.
D. Indicates fountain for man and beast. Automatic fixtures for both. In service during warm weather only.
E. Indicates cold water fountain for man only. Automatic fixtures. In service during warm weather only.
F. Indicates fountain for man and beast, with automatic fixtures for man in warm weather and a continuous flow of water for beasts all the year.
G. Indicates fountain for man and beast. Hygienic "bubble" fixtures for man. Continuous flow of water for man and beast all the year.

SUMMARY OF STATISTICS FOR THE YEAR ENDING JANUARY 1, 1909. (FINANCIAL, JANUARY 31, 1909.)

[*In form recommended by the New England Water Works Association.*]

BOSTON WATERWORKS.

Boston. (City.)	Suffolk. (County.)	Massachusetts. (State.)

GENERAL STATISTICS.

Population by census of 1905, 595,380.
Date of construction, 1848.
By whom owned, supplied by state; distribution system owned by city.
Source of supply, Nashua and Sudbury rivers; Lake Cochituate.
Mode of supply (whether gravity or pumping), pumping and gravity (all pumps operated by state).

FINANCIAL STATISTICS.

RECEIPTS.

From ordinary (maintenance) receipts	$2,695,761 00	
Total		$2,695,761 00

From Water Rates.

Fixture rates	$1,369,681 06	
Meter rates	1,256,883 53	
Total from consumers		$2,626,564 59
From other sources		69,196 41
Total		$2,695,761 00

EXPENDITURES.

Waterworks Maintenance and Extension.

Operation (management, repairs and extension)	$729,677 14	
Total maintenance and extension		$729,677 14
Interest on bonds		175,010 17
Metropolitan water assessment		1,789,315 84
Refunded water rates		1,757 85
Total		$2,695,761 00
Disposition of balance:		
Net cost of works to date		$17,257,461 89
Bonded debt at date		4,249,500 00
Value of sinking fund at date		3,637,956 71

Average rate of interest, $3\frac{89}{100}$ per cent.

STATISTICS OF CONSUMPTION OF WATER.

Estimated total population at date, 618,000.
Estimated population on lines of pipe, 618,000.*
Passed through meters, 8,254,080,000 gallons.
Percentage of consumption metered, 22.9.
Average daily consumption, 98,379,300 gallons.
Gallons per day to each inhabitant, 158.*

* No allowance for daily floating population.

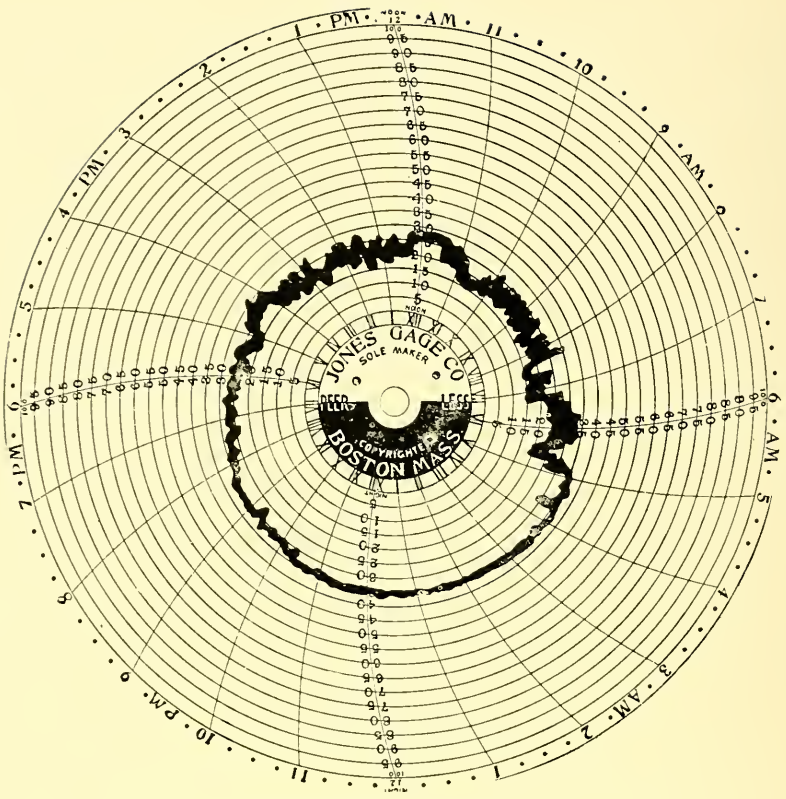
STATISTICS RELATING TO DISTRIBUTION SYSTEM.

MAINS.

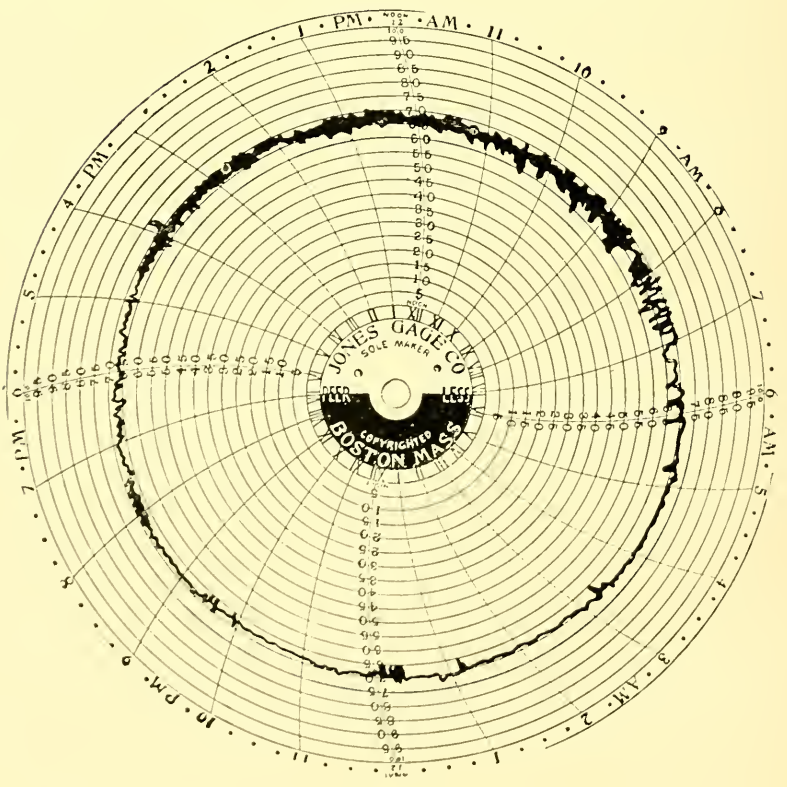
Kind of pipe, cast iron.
Sizes, from 4-inch to 48-inch.
Extended, 57,527 feet during year.
Discontinued, 25,496 feet during year.
Total now in use, 753.17 miles.
Cost of repairs per mile, $29.42.
Number of leaks per mile, 3.
Length of pipes less than 4 inches diameter, 2.14 miles.
Number of hydrants added during year (public and private), 86.
Number of hydrants (public and private) now in use, 8,227.
Number of stop gates added during year, 118.
Number of stop gates now in use, 10,001.
Number of stop gates smaller than 4-inch, 17.
Number of blow-offs, 380.
Range of pressure on mains, 20 pounds to 90 pounds.

SERVICES.

Kind of pipe, lead, lead-lined iron and cast iron.
Sizes, $\frac{3}{4}$-inch to 16-inch.
Extended, 27,138 feet.
Discontinued, 4,812 feet.
Total now in use, 528.29 miles.
Number of service taps added during year, 1,255.
Number now in use, 95,045.
Average length of service, 29.34 feet.
Average cost of service for the year, $23.66.
Number of meters added, 434.
Discontinued, 238.
Number now in use, 5,380.
Percentage of services metered, $5\frac{66}{100}$.
Percentage of receipts from metered water (meter rates divided by total from consumers), $47\frac{85}{100}$.
Number of motors and elevators added, 13.
Number now in use, 702.



DECEMBER 8, 1908.



JANUARY 17, 1909.

REPORT OF THE ENGINEER.

Boston, February 1, 1909.

William E. Hannan, Esq.,
Water Commissioner:

Dear Sir,— The amount of work done by contract in the Water Department has largely increased during the past two years; this has added materially to the work of the Engineering Department, involving as it does not only the necessary studies, preparation of plans, specifications, etc., but the supervision of the work done and the making of estimates for payment.

During the past year the number of these contracts numbered thirty-seven.

The 48-inch low service main laid last year from Tremont street through Prentiss street and Longwood avenue to Brookline avenue was extended in Longwood avenue to connect at Muddy river with the 48-inch line laid by the Metropolitan Water and Sewerage Board from Coolidge's Corner, Brookline; this new feed greatly strengthens the supply to the city and will still further strengthen it when the Metropolitan Board extends the 48-inch pipe from Coolidge's Corner to Chestnut Hill Reservoir, as it proposes to do early in the coming season.

Two lines of flexible pipe were laid to improve the harbor service. One, between Long Island and Rainsford Island, a 4-inch pipe, 3,534 feet in length, to replace a pipe of the same size laid in 1895; and the other, between Moon Island and Long Island, a 12-inch pipe, 3,231 feet long, to supplement a 6-inch line laid in 1895, which for several years past has been too small to furnish a satisfactory supply for Long, Rainsford, Gallop's and Lovell's islands and for Fort Warren; the effect of putting this 12-inch line into service is shown on opposite page by gauge dials from Long Island taken before and after the line was turned on.

The flexible pipes were laid in a trench 5 feet deep, by means of a long chute extending from the deck of a lighter to the bottom of the trench, the lighter being pulled ahead as each pipe was jointed. The pipes were tested for leakage before the trench was refilled and again after refilling, and the

actual leakage found, under 85 pounds pressure, in the two lines after the completion of the work was as follows:

3,534 linear feet, 4-inch, Long to Rainsford, 0.086 cubic feet per minute.
3,231 linear feet, 12-inch, Moon to Long, 0.036 cubic feet per minute.

The 20-inch and 30-inch low service and 16-inch high service mains on Warren Bridge are in a very unsafe location, the 30-inch and 16-inch pipes being particularly a source of anxiety, as they have already failed several times by pulling apart. They are laid under the flooring of the bridge with six 90° bends, the unbalanced pressures from which can only be transferred by rods and struts to the wooden bridge structure, which was built in 1883–84. On account of the age of the bridge there is nothing sufficiently substantial to fasten to and the result is frequent and dangerous movements of the pipes. The low service pipes have not been in use under usual conditions since 1898, when the state began to supply water to the city and the pressure in Charlestown was raised about 15 pounds above that in the City Proper. It has, however, been necessary to put them in service a number of times when one or more of the regular supply mains have been out of commission. In the event of a very serious fire in the downtown district an effective head might only be maintained through their use, and the ability to obtain a supply from the northern low service of the Metropolitan waterworks by means of these pipes would be invaluable in time of conflagration or serious accident by making available the large storage of Spot pond at a time when such help was vital.

The 16-inch pipe on the Warren Bridge is the only feed for the high service district of Charlestown and its failure would destroy high service in that section. I recommend that a tunnel large enough to carry a 36-inch and a 16-inch pipe be built under the Charles river in the neighborhood of Warren Bridge,— the approximate cost of this work is $100,000.

East Boston is supplied by the Metropolitan Water and Sewerage Board through two lines of 24-inch pipe crossing Chelsea creek from Chelsea to East Boston. These pipes, laid in 1871 and 1900, are laid on the bottom of the creek and are entirely exposed above low water mark on each shore; their location is particularly dangerous on the Chelsea shore, where the pipes lie in a dock about 200 feet long and 100 feet wide, closely built up on each side; at one point a brick building, 62 feet high, is located within 43 feet of the nearest pipe and on the opposite side of the dock a wooden building, 28 feet high, is 43 feet distant from the pipes. These buildings are

very inflammable and in the event of their destruction by fire at a time when the tide was low, the waterpipes would be in great danger from falling walls and from heat. The safety of this supply is further imperiled by the weakened condition of the mains owing to electrolysis; the actual conditions found in the pipes are described as follows on page 136 of the Sixth Annual Report of the Metropolitan Water and Sewerage Board: "Examination of the pipes showed that they were badly disintegrated; at one point a hole was cut clear through the pipe while making the examination, causing a leak which had to be plugged."

A new and independent supply main for East Boston should be laid without delay.

The "double high" service of West Roxbury comprises substantially that part of the territory above grade 170. The supply for this service is pumped by the Metropolitan Water and Sewerage Board at a pumping station, formerly operated by the City of Boston, on Washington street, near Metropolitan avenue. The water is delivered by the pumps directly into the mains and thence into a standpipe on Mt. Bellevue in the southerly end of the district; from this standpipe the system extends about $1\frac{1}{2}$ miles in a westerly and more than 4 miles in a northerly direction and for about $2\frac{3}{4}$ miles of the distance through a single line of pipe. The water supply under these conditions is very unreliable. I recommend for the purpose of guarding the supply that a second standpipe be built in the northerly part of the system, and that more storage be provided on Mt. Bellevue.

The storage for the high service supply of the city is limited to Fisher Hill Reservoir, built by the city in 1887 and containing when full 15,000,000 gallons, and to a reservoir in Newton, on Waban Hill, containing 13,500,000 gallons, a total quantity of water sufficient for about a day's supply, while there is a high service storage reservoir containing 41,400,000 gallons for the municipalities north of the city to safeguard a daily consumption of but 9,000,000 gallons daily. This condition of the City of Boston high service supply is not in accord with conservative practice; an accident might occur to the pumping machinery at Chestnut Hill of such a nature that repairs could not be made in a day's time. I recommend that a storage reservoir or reservoirs be built on the high service system, large enough to hold at least six days' supply for the entire high service of the city. This reservoir is of such importance to the city that if the Metropolitan Board for any reason cannot construct it the city should do so, especially as in the event of

its construction by the state the city would have to pay for 80 per cent of the cost of construction.

The daily average consumption of water in the city during the past year was 98,379,300 gallons, or 158 gallons per capita; of this amount at least one-third is preventable waste, due to leaks which it is possible to locate and to improper use of water. For several years past no serious attempt has been made to restrict waste, and the water takers have lost sight of the fact that water is a commodity of value and that its use should be restricted. Under the provisions of chapter 524 of the Acts of 1907 the city is required to meter annually 5 per cent of the unmetered services as well as all new ones. Assuming that eventually meters on every service will bring about a normal consumption, still other methods are necessary if the desired result is to be had in a reasonable length of time; in fact, other methods must be employed in any event if the large waste in the main pipes and services is to be checked.

The Deacon waste water meter is an instrument that records the rate of flow into any particular section of the pipe system and, when operated in connection with an efficient inspection service, it forms a most efficient means of detecting waste. The city now is equipped with eighty-five of these meters, or enough to cover the entire city; they should be operated in connection with a thoroughly efficient force of inspectors, and a rigid system of fines should be imposed in case of failure to repair leaks after reasonable notice. In addition, the water used in public buildings, schoolhouses, etc., should be at once metered and a charge made at least for all water wasted. Further, all city and state departments should be required to make daily or weekly returns to the Water Commissioner, giving data by which the water used from hydrants and standpipes may be (approximately) estimated. There seems to be no reason why the consumption should not be reduced at least to 100 gallons per capita.

Yours respectfully,

WILLIAM JACKSON,
City Engineer.

Average Stated Monthly Heights, in Feet, above City Base, to which Water Rose at Different Stations, on the Boston Water Works.

1908. Month	Chestnut Hill Pumping Station, Brighton 3 a.m.	9 a.m.	1 p.m.	5 p.m.	[illegible] Common 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Engine House No. [illegible] Salem Street 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Engine House No. 7 East Street 3 a.m.	9 a.m.	1 p.m.	5 p.m.
January	140.4	165.0	160.1	158.7					125.4	116.4	117.7	110.9	128.1	119.1	122.1	121.2
February	142.5	167.3	161.9	160.4	121.7	117.5	118.9	121.3	118.8	110.5	112.2	115.0	121.9	114.2	116.1	117.8
March	141.3	165.8	160.2	158.3	131.7	123.9	125.0	127.2	126.9	117.5	118.7	120.5	129.9	120.8	122.2	124.0
April	139.9	165.4	159.2	158.4	134.1	126.1	126.5	129.1	128.8	119.3	120.4	121.6	131.2	121.8	123.8	121.9
May	140.6	164.3	158.7	157.8	134.8	124.0	125.8	128.7	129.3	117.3	119.0	121.0	132.0	120.3	122.3	124.7
June	142.4	166.9	159.8	159.8	135.3	122.8	123.5	127.6	120.8	115.6	116.0	121.2	132.6	117.5	121.2	124.2
July	140.3	165.6	158.4	158.0	133.0	123.4	124.0	127.6	127.9	116.0	116.6	120.0	130.0	119.1	122.0	122.7
August	140.7	166.0	159.8	158.0	135.7	126.7	128.6	130.5	129.6	119.2	120.8	123.1	131.6	122.5	125.2	126.0
September	142.4	166.0	159.0	157.9	137.7	127.3	127.2	130.6	131.4	118.4	118.3	123.4	134.7	121.2	124.8	126.8
October	143.2	166.0	159.2	158.6	140.1	129.6	129.1	132.5	133.2	121.5	122.7	125.2	135.7	123.8	126.2	127.9
November	145.6	164.0	158.2	157.2	143.7	130.2	130.6	133.2	136.1	123.2	123.4	125.4	138.7	123.5	125.3	126.7
December	141.3	165.6	158.5	157.6	135.0	128.6	129.0	130.4	129.0	120.8	121.6	122.8	132.0	124.8	124.5	127.0

1908. Month	Engine House No. 38, Congress Street, South Boston 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Boston Water Department Yard, No. 710 Albany Street, Roxbury 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Engine House No. 2, Fourth and O Streets, South Boston 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Engine House No. 34, Western Avenue, Brighton 3 a.m.	9 a.m.	1 p.m.	5 p.m.	Engine House No. 32 Bunker Hill Street, Charlestown 3 a.m.	9 a.m.	1 p.m.	5 p.m.
January	121.7	111.9	112.2	114.9	126.3	117.8	119.7	122.2	122.9	111.4	114.7	116.9	139.5	140.3	141.7	141.9	159.4	149.1	152.5	154.1
February	113.6	104.5	106.3	108.0	119.6	112.9	114.7	116.8	116.4	106.2	109.0	110.9	134.6	135.8	137.7	137.8	161.0	154.6	156.8	156.2
March	123.8	112.4	113.6	115.9	127.4	118.8	120.5	122.3	123.2	111.8	115.1	116.1	135.7	136.0	137.1	137.1	163.4	156.8	157.2	157.0
April	125.2	113.9	115.3	118.7	128.1	120.8	122.3	124.3	126.2	113.6	117.7	119.3	137.2	137.2	139.2	140.5	163.8	155.2	157.3	157.6
May	126.1	112.7	114.7	118.5	128.4	118.7	122.5	123.6	127.5	111.9	116.3	119.0	139.2	137.1	138.7	139.8	164.4	156.1	157.4	157.7
June	126.0	110.0	112.8	117.1	129.2	117.8	122.2	122.3	128.5	110.3	115.1	118.2	140.2	135.5	138.1	140.2	170.2	160.7	162.4	161.5
July	124.9	111.1	113.0	116.1	128.0	118.6	122.7	121.5	126.7	110.9	115.7	116.7	138.3	138.3	139.4	138.5	160.6	162.1	163.5	162.7
August	125.7	113.3	116.1	118.2	128.9	120.8	126.1	124.9	127.8	113.5	118.9	119.1	130.1	131.0	137.2	136.9	168.5	162.9	163.4	162.0
September	128.5	113.6	115.1	119.8	132.0	119.7	125.6	124.5	130.5	113.7	118.0	121.2	141.0	137.1	141.9	137.1	167.0	161.2	162.5	160.4
October	131.0	118.6	119.2	123.1	133.7	121.1	126.4	127.3	133.6	119.8	121.0	123.9	142.7	143.2	142.3	139.3	162.9	158.9	159.3	158.7
November	134.2	119.8	120.0	123.7	136.6	125.0	125.6	127.1	136.2	120.1	121.8	124.3	145.5	143.9	141.7	141.1	163.5	159.9	159.0	159.1
December	126.7	116.2	116.8	120.6	129.0	122.8	123.0	125.4	127.3	117.3	118.9	120.7	138.5	142.7	111.4	130.6	164.2	158.4	159.0	158.2

1908. Month	Engine House No. [illegible] Marion Street East Boston 3 a.m.	9 a.m.	1 p.m.	5 p.m.	City Hall, High Service 3 a.m.	9 a.m.	Engine House No. 24, Quincy Street, Roxbury High Service 3 a.m.	9 a.m.	Engine House No. 19, Norfolk Street, Dorchester High Service 3 a.m.	9 a.m.	Engine House No. 28 Centre Street, Jamaica Plain High Service 3 a.m.	9 a.m.	Engine House No. 29 Chestnut Hill Avenue, Brighton High Service 3 a.m.	9 a.m.	Water Department Yard Gibson Street, Dorchester 3 a.m.	9 a.m.	1 p.m.	5 p.m.
January	149.7	135.1	139.3	141.9	245.7	233.9	244.3	234.3	248.1	241.6			248.9	246.3	121.8	110.5	115.2	116.8
February	142.6	130.0	134.3	135.8	244.2	232.5	242.0	231.7	245.7	238.7			247.6	244.8	118.0	101.9	106.2	107.7
March	152.1	138.2	142.4	144.5	246.2	234.7	244.5	232.8	248.7	242.1			246.5	243.3	131.2	119.9	122.9	124.1
April	151.8	139.0	142.3	144.4	246.3	233.8	244.5	232.6	248.4	241.4			246.8	243.9	132.7	121.1	124.9	125.6
May	153.7	140.2	143.6	146.0	244.7	232.1	244.8	229.3	246.9	238.5			247.1	242.9	133.4	119.5	124.2	125.0
June	154.1	138.4	142.8	144.3	244.0	229.4	243.9	228.1	245.4	234.8			247.5	242.4	134.3	116.8	121.6	124.1
July	153.6	138.2	143.3	143.9	244.1	231.6	244.4	231.0	246.0	237.4			246.9	243.0	132.5	118.4	124.0	122.6
August					244.6	233.5	244.5	231.7	246.6	230.4	248.2	242.5	247.0	243.5	131.7	119.2	125.2	124.2
September					244.4	232.7	244.4	231.2	247.3	238.0	248.8	241.5	246.9	243.2	134.3	119.6	126.6	125.4
October	152.0	140.0	142.3	142.1	245.3	232.7	244.4	231.0	247.6	238.8	248.9	241.9	247.1	244.2	135.9	122.7	127.0	128.9
November	154.9	144.8	146.0	148.5	246.4	234.6	246.2	233.8	248.4	239.9	248.9	242.9	247.9	244.8	135.6	121.4	124.6	124.3
December	153.1	142.7	145.1	145.5	245.1	233.8	244.4	232.1	247.1	239.6	248.1	242.9	247.0	244.4	128.0	116.4	120.2	120.8

Monthly Rainfall in Inches During 1908 in Various Places in Eastern Massachusetts.

PLACES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Framingham	3.24	4.22	3.67	1.75	5.41	0.71	3.43	4.36	0.96	2.52	0.89	2.95	34.14
Dam 4, Ashland	3.43	4.60	3.84	1.81	5.94	0.90	3.48	4.30	0.89	2.53	0.90	3.07	35.69
Cordaville	4.21	5.28	4.26	2.14	5.56	1.02	4.18	5.39	1.12	2.63	1.12	3.53	40.44
Lake Cochituate	3.33	4.30	3.62	1.80	4.58	0.82	3.91	3.98	0.77	2.37	0.85	2.70	33.03
Chestnut Hill, Reservoir	4.50	6.22	4.18	2.64	4.56	1.28	4.18	5.56	1.22	4.34	1.17	3.46	43.31
Spot Pond	3.48	4.27	3.26	2.41	3.81	0.78	3.40	3.97	0.62	3.66	1.04	2.65	33.55
Cambridge Observatory	3.55	3.60	2.81	1.31	4.00	1.25	3.34	4.01	0.83	3.45	0.81	2.70	31.66
Waltham, Boston Manufacturing Company	9.14	4.05	4.03	1.87	3.59	2.00	3.80	4.06	0.83	3.29	0.83	2.60	40.09
Lowell, Locks and Canals Company	3.20	4.96	2.71	1.96	4.19	0.93	3.04	4.29	0.34	2.57	1.14	3.03	32.36
Main Drainage Yard, 795 Massachusetts avenue	2.82	3.91	3.47	1.62	4.13	2.06	3.64	4.24	0.60	3.70	1.37	2.57	34.13
Average of above ten places	4.09	4.54	3.59	1.93	4.58	1.18	3.64	4.42	0.82	3.11	1.01	2.93	35.84

GENERAL STATISTICS.

BOSTON WATER DEPARTMENT.

Daily average amount used during year 1908 (gallons)	98,379,300
Daily average amount used through meters during year 1908 (gallons)	22,557,600
Number of services February 1, 1909	95,045
Number of meters in service February 1, 1909	5,380
Number of meters under supervision February 1, 1909	118
Number of elevators under supervision February 1, 1909	584
Length of supply and distributing mains, in miles, February 1, 1909	753.17
Number of public hydrants in use February 1, 1909	7,919
Yearly revenue from annual rates (assessed)	$1,382,789.78
Yearly revenue from metered water (assessed)	$1,260,363.18
Percentage of total revenue from metered water	47.7
Yearly expense of maintenance	$551,773.02

CIVIL ORGANIZATION OF THE WATERWORKS, FROM THEIR COMMENCEMENT TO FEBRUARY 1, 1909.

WATER COMMISSIONERS.

NATHAN HALE,* JAMES F. BALDWIN,* THOMAS B. CURTIS.* From May 4, 1846, to January 4, 1850.

ENGINEERS FOR CONSTRUCTION.

JOHN B. JERVIS, of New York, Consulting Engineer. From May, 1846, to November, 1848.*

E. S. CHESBROUGH, Chief Engineer of the Western Division. From May, 1846, to January 4, 1850.*

WILLIAM S. WHITWELL, Chief Engineer of the Eastern Division. From May, 1846, to January 4, 1850.*

ENGINEERS HAVING CHARGE OF THE WORKS.

E. S. CHESBROUGH, Engineer. From November 18, 1850, to October 1, 1855.*

GEORGE H. BAILEY, Assistant Engineer. From January 27, 1851, to July 19, 1852.*

H. S. MCKEAN, Assistant Engineer. From July 19, 1852, to October 1, 1855.*

JAMES SLADE, Engineer. From October 1, 1855, to April 1, 1863.*

N. HENRY CRAFTS, Assistant Engineer. From October 1, 1855, to April 1, 1863.

N. HENRY CRAFTS, City Engineer. From April 1, 1863, to November 25, 1872.

THOMAS W. DAVIS, Assistant Engineer. From April 1, 1863, to December 8, 1866.*

HENRY M. WIGHTMAN, Resident Engineer at Chestnut Hill Reservoir. From February 14, 1866, to November, 1870.*

A. FTELEY, Resident Engineer on construction of Sudbury river works. From May 10, 1873, to April 7, 1880.*

JOSEPH P. DAVIS, City Engineer. From November 25, 1872, to March 20, 1880.

HENRY M. WIGHTMAN, City Engineer. From April 5, 1880, to April 3, 1885.*

WILLIAM JACKSON, City Engineer. From April 21, 1885, to present time.

DESMOND FITZGERALD, Resident Engineer on Additional Supply. From February 20, 1889, to January 1, 1896.

After January 4, 1850, Messrs. E. S. CHESBROUGH, W. S. WHITWELL and J. AVERY RICHARDS were elected a water board, subject to the direction of a joint standing committee of the City Council, by an ordinance passed December 31, 1849, which was limited to keep in force one year; and in 1851 the Cochituate Water Board was established.

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* Deceased.

COCHITUATE WATER BOARD.

Presidents of the Board.

THOMAS WETMORE, elected in 1851, and resigned April 7, 1856.‡
JOHN H. WILKINS, elected in 1856, and resigned June 5, 1860.‡
EBENEZER JOHNSON, elected in 1860, term expired April 3, 1865.‡
OTIS NORCROSS, elected in 1865, and resigned January 15, 1867.‡
JOHN H. THORNDIKE, elected in 1867, term expired April 6, 1868.‡
NATHANIEL J. BRADLEE, elected April 6, 1868, and resigned January 4 1871.‡
CHARLES H. ALLEN, elected January 4, 1871, to May 4, 1873.‡
JOHN A. HAVEN, elected May 4, 1873, to December 17, 1874.‡
THOMAS GOGIN, elected December 17, 1874, and resigned May 31, 1875.‡
L. MILES STANDISH, elected August 5, 1875, to July 31, 1876.‡

Members of the Board.

THOMAS WETMORE, 1851, 52, 53, 54 and 55.‡
JOHN H. WILKINS, 1851, 52, 53, *56, 57, 58 and 59.‡
HENRY B. ROGERS, 1851, 52, 53, *54 and 55.‡
JONATHAN PRESTON, 1851, 52, 53 and 56.‡
JAMES W. SEAVER, 1851.‡
SAMUEL A. ELIOT, 1851.‡
JOHN T. HEARD, 1851.‡
ADAM W. THAXTER, Jr., 1852, 53, 54 and 55.‡
SAMPSON REED, 1852 and 1853.‡
EZRA LINCOLN, 1852.‡
THOMAS SPRAGUE, 1853, 54 and 55.‡
SAMUEL HATCH, 1854, 55, 56, 57, 58 and 61.‡
CHARLES STODDARD, 1854, 55, 56 and 57.‡
WILLIAM WASHBURN, 1854 and 55.‡
TISDALE DRAKE, 1856, 57, 58 and 59.‡
THOMAS P. RICH, 1856, 57 and 58.‡
JOHN T. DINGLEY, 1856 and 59.‡
JOSEPH SMITH, 1856.‡
EBENEZER JOHNSON, 1857, 58, 59, 60, 61, 62, 63 and 64.‡
SAMUEL HALL, 1857, 58, 59, 60 and 61.‡
GEORGE P. FRENCH, 1859, 60, 61, 62 and 63.‡
EBENEZER ATKINS, 1859.‡
GEORGE DENNIE, 1860, 61, 62, 63, 64 and 65.‡
CLEMENT WILLIS, 1860.‡
G. E. PIERCE, 1860.‡
JABEZ FREDERICK, 1861, 62 and 63.‡
GEORGE HINMAN, 1862 and 63.
JOHN F. PRAY, 1862.‡
J. C. J. BROWN, 1862.
JONAS FITCH, 1864, 65 and 66.‡
OTIS NORCROSS, *1865 and 66.‡
JOHN H. THORNDIKE, 1864, 65, 66 and 67.‡
BENJAMIN F. STEVENS, 1866, 67 and 68.
WILLIAM S. HILLS, 1867.
CHARLES R. TRAIN, 1868.‡
JOSEPH M. WIGHTMAN, 1868 and 69.‡

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* Mr. John H. Wilkins resigned November 15, 1855, and Charles Stoddard was elected to fill the vacancy. Mr. Henry B. Rogers resigned October 22, 1865. Mr. Wilkins was re-elected February, 1856, and chosen president of the Board, which office he held until his resignation, June 5, 1860, when Mr. Ebenezer Johnson was elected president; and July 2, Mr. L. Miles Standish was elected to fill the vacancy occasioned by the resignation of Mr. Wilkins. Otis Norcross resigned January 15, 1867, having been elected Mayor of the city. Benjamin James served one year, in 1858, and was re-elected in 1868. Alexander Wadsworth served six years, 1864–69, and was re elected in 1872. Thomas Gogin resigned May 31, 1875. Charles E. Powers was elected July 15, to fill the vacancy occasioned by the resignation of Mr. Gogin.

‡ Deceased.

BENJAMIN JAMES,*1858, 68 and 69.‡
FRANCIS A. OSBORN, 1869.
WALTER E. HAWES, 1870.‡
JOHN O. POOR, 1870.
HOLLIS R. GRAY, 1870.
NATHANIEL J. BRADLEE, 1863, 64, 65, 66, 67, 68, 69, 70 and 71.‡
GEORGE LEWIS, 1868, 69, 70 and 71.‡
SIDNEY SQUIRES, 1871.‡
CHARLES H. HERSEY, 1872.
CHARLES H. ALLEN, 1869, 70, 71 and 72.‡
ALEXANDER WADSWORTH, *1864, 65, 66, 67, 68, 69 and 72.‡
CHARLES R. MCLEAN, 1867, 73 and 74.‡
EDWARD P. WILBUR, 1873 and 74.‡
JOHN A. HAVEN, 1870, 71, 72, 73 and 74.‡
THOMAS GOGIN, 1873, 74 and 75.*‡
AMOS L. NOYES, 1871, 72 and 75.
WILLIAM G. THACHER, 1873, 74 and 75.‡
CHARLES J. PRESCOTT, 1875.‡
EDWARD A. WHITE, 1872, 73, 74, 75 and 76.‡
LEONARD R. CUTTER, 1871, 72, 73, 74, 75 and 76.†‡
L. MILES STANDISH, 1860, 61, 63, 64, 65, 66, 67, 74, 75 and 76.†‡
CHARLES E. POWERS, *1875 and 1876.†‡
SOLOMON B. STEBBINS, 1876.†
NAHUM M. MORRISON, 1876.†‡
AUGUSTUS PARKER, 1876.†‡

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* See note on preceeding page.
† Served until the organization of the Boston Water Board.
‡ Deceased.

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[1] BOSTON WATER BOARD.

ORGANIZED JULY 31, 1876.

* TIMOTHY T. SAWYER, from July 31, 1876, to May 5, 1879; and from May 1, 1882, to May 4, 1883.
* LEONARD R. CUTTER, from July 31, 1876, to May 4, 1883.
* ALBERT STANWOOD, from July 31, 1876, to May 7, 1883.
* FRANCIS THOMPSON, from May 5, 1879, to May 1, 1882.
WILLIAM A. SIMMONS, from May 7, 1883, to August 18, 1885.
GEORGE M. HOBBS, from MAY 4, 1883, to MAY 4, 1885.
JOHN G. BLAKE, from May 4, 1883, to August 18, 1885.
WILLIAM B. SMART, from May 4, 1885, to March 18, 1889.
* HORACE T. ROCKWELL, from August 25, 1885, to April 25, 1888.[2]
THOMAS F. DOHERTY, from August 26, 1885, to May 5, 1890; and from May 4, 1891, to July 1, 1895.
ROBERT GRANT, from April 25, 1888, to July 17, 1893.[3]
PHILIP J. DOHERTY, from March 18, 1889, to May 4, 1891.
* JOHN W. LEIGHTON, from May 5, 1890, to July 1, 1895.
WILLIAM S. MCNARY, from August 15, 1893, to November 5, 1894.[3]
CHARLES W. SMITH, from January 23, 1895, to July 1, 1895.

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[1] Under chapter 449 of the Acts of 1895 the Boston Water Board was abolished, and the Water Supply and Water Income Departments consolidated and placed under the charge of one Water Commissioner.
* Deceased. [2] Died in office. [3] Resigned.

[1] WATER COMMISSIONERS.

CHARLES W. SMITH, from July 1, 1895, to January 20, 1896.[3]
JEREMIAH J. MCCARTHY (Acting), from January 20 to February 1, 1896.
JOHN R. MURPHY, from February 1, 1896, to October 17, 1899.[3]
BENJAMIN W. WELLS (Acting), from October 17, 1899, to December 28, 1899.
* AUGUSTUS P. MARTIN, from December 28, 1899, to March 13, 1902.[2]
JAMES DONOVAN (Acting), from March 14 to March 17, 1902.
EUGENE S. SULLIVAN, from March 17, 1902, to January 11, 1906.[3]
WILLIAM JACKSON (Acting), from January 11, 1906, to March 1, 1906.
WILLIAM J. WELCH, from March 1, 1906, to April 27, 1908.[3]
WILLIAM E. HANNAN, from April 27, 1908, to present time.

Assistant Water Commissioners.

JEREMIAH J. MCCARTHY, from July 1, 1895, to January 20, 1896.
EDWARD C. ELLIS, from February 17, 1896, to November 1, 1900.
* MELVIN P. FREEMAN, from February 7, 1900, to March 9, 1902.[3]
WILLIAM H. OAKES, from November 1, 1900, to March 9, 1902.[3]
EUGENE S. SULLIVAN, from March 10 to March 17, 1902.
JOHN J. LEAHY, from March 21, 1902, to March 1, 1906.
ISAAC ROSNOSKY, from March 10, 1902, to present time.
JOSEPH J. NORTON, from March 1, 1906, to March 26, 1908.
JAMES P. LENNON, from March 1, 1906, to March 26, 1908.

Chief Clerk of the Department.

WALTER E. SWAN.

General Superintendent Income Division.

JOSEPH H. CALDWELL.

In Charge of Distribution Division.

Assistant Commissioner, JAMES P. LENNON, to March 26, 1908.
Chief Clerk, GEORGE H. FINNERAN, from March 26, 1908, to present time.

City Engineer and Engineer of the Department.

WILLIAM JACKSON.

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[1] See note on preceding page.
* Deceased. [2] Died in office. [3] Resigned

ALLIED PRINTING TRADES UNION LABEL COUNCIL BOSTON MASS. 21